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ELECTRICAL WORLD AND ENGINEER.

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STREET RAILWAY PROBLEMS.

The meeting which has been held this week at Detroit by the American Street Railway Association has been of wonted magnitude and well-sustained interest. As was pointed out in these pages last week, the city chosen for the annual convention this year has many attractions for street railway men, whether from the standpoint of historical associations or because of the interesting developments that have made Detroit the center of a vast network of rural and interurban trolley lines. This outreaching for new territory and exterior connections, as evidenced by the long-distance trolley system of Michigan, is indeed symptomatic of the whole attitude of the electric railway art, and of the newer conditions that were so admirably delineated and emphasized by Mr. Vreeland in his broad-visioned presidential address—one of the best that the association has ever heard.

Perhaps it was only natural that a street railway manager who began his brilliant career on steam railroads, should be keen and prompt to see the wider aspects of the industry in which he is one of the most conspicuous figures; but be that as it may, there is no denying that President Vreeland touched deftly on the topics about which we are all thinking, and showed in many luminous passages how wide is the field of the "street car" and the "trolley." Indeed, he did not overstate the case when he said: "It should be understood that the Association is not merely a street railway association, but its scope covers the entire field of electric railway transportation." This is true, even though it may not be necessary or judicious to change the name of the Association in order to conform with the facts. An analogous case is presented in the National Electric Light Association, most of whose members are to-day selling a large proportion of their current to run motors, lift elevators, feed storage batteries, perform electrometallurgical operations, supply telegraph and telephone plants and help any lady curl her hair or ply the chafing dish in domestic seclusion. In all branches of electricity, "the greater lies before," and in none more irresistibly than in that of electric traction.

It is in reality quite significant and suggestive that the president of a street railway association, himself the active, vigilant manager of the greatest urban street car system in the world, devoted the major part of a strong "inaugural message" to questions outside the narrower and more immediately pressing topics of city transportation. To those of us who dwell in city limits, it would seem that there alone are difficulties and needs enough to demand the best ability of the times; but Mr. Vreeland showed how the ubiquitous trolley and the all-prevading electric motor has opened up novel vistas that it will take many years to make familiar.

We find him talking about interurban roads, long-distance service, exchange of traffic with old steam roads, freight and express by trolley, and the deep interest shown by trunk steam railroad management in what lies ahead at no very distant future. The demands on ability and capital in these new departures is tremendous, but the engineers, such as Sprague, Arnold, Potter, Stillwell, Lamme and others, who have launched us all on these newer and greater enterprises are fully able with the financial support that is so generously given them, to win abundant success, and to make, in due time, the whole domain of transportation thoroughly electrical.

International Regulation of Wireless Telegraphy.

Those who would put under close governmental supervision "natural monopolies" are welcome to what comfort they can find in a movement now on foot to curb wireless telegraphy, owing to its claim on the ether of the universe as a medium of transmission. The thought of a French message traversing the ether over and in German soil—or of a message proceeding from any source without bureaucratic supervision—was evidently disturbing to the Kaiser, and he has taken the initiative in a movement having for its object to bring the new art under international governmental control. One can readily agree with the German government, which has taken up the matter so seriously, that wireless telegraphy most nearly approaches to what has been vaguely denominated by the term "natural monopoly," and reasonably admits of some international control; but we have a suspicion that had Slaby instead of Marconi controlled the new art, the German representations made to other States would probably have been confined to the political and maritime aspects of the question, and such great concern would not be manifested in relation to the plans of the Marconi Company, which are pronounced as threatening a commercial monopoly. Moreover, if Prof. Slaby, who appears to be very close to the German government, has really perfected a practical system of syntonic wireless telegraphy as is claimed, that part of the representations set forth which relates to interference loses in considerable part its force.

As reported by a correspondent of the London *Times*, the German government has invited England, France, Russia, Italy, Austria-Hungary and the United States to make arrangements for a meeting of delegates to provide for an international congress on the subject of wireless telegraphy. The principal work of the proposed congress will be to draw up rules settling the conditions under which the establishment of stations for wireless telegraphy shall be allowed, and the ultimate co-operation of all maritime states is contemplated. It is announced that the proposal of the German government has been met in a friendly spirit by the governments interested, and that the appointment of delegates by these powers may be anticipated in the near future. It must be admitted that in the present state of the art the matter of interference—either with or without design—is a vital one, and to this extent some agreement may be advisable among the nations of the world, particularly as concerns maritime wireless telegraphy. It may be recalled that at the time of one of the yacht races off New York, the wireless telegraph service was rendered almost entirely useless, owing, it was charged, to interference set up by one of the wireless companies. It is sincerely to be hoped, however, that any regulation that may be decided upon at the proposed conference will be confined to the narrowest possible compass consistent with the object to derive for the public the greatest possible benefit from the new art. Governmental regulation is always an evil only to be excused on the score of tending to the prevention of a greater evil. The manner in which electrical development in Great Britain has been trammeled by regulations laid down in the early days of the art is an object lesson that should not escape those who would lay down regulations affecting an art which as yet is only in an embryo state of development.

The Metric System.

Elsewhere we reprint a consular report to the State Department on the status of the metric system movement in Great Britain, which, it will be seen, is extremely encouraging. The advocacy of the reform by the colonial premiers will undoubtedly have a powerful influence, and with almost 300 members of Parliament pledged in favor of the adoption of the system, besides all the chambers of Commerce, nearly all the school boards, and the trade unions, the prospects of the passage of a bill in the near future by the British Parliament are indeed promising. This situation renders it extremely important that our Congress should at the earliest possible moment take action on the metric bill before it. It is quite probable that such action would be favorable, and if taken in time would relieve us from the alternative of later being placed in the position of merely following in the footsteps of Great Britain; for the adoption of the system by that country would, from the bearing on export trade, inevitably drive us to it regardless of all other considerations. At the recent session of Congress, the House Committee on Rules favored the bill to the extent of pledging that it would be granted a day for consideration, but owing to an adjournment of Congress earlier than was expected, it was laid over. The bill will undoubtedly be brought up at the coming session, and unless its friends are grievously mistaken in their canvass, a large majority will register approval of the desire of the enlightened to be relieved from the incubus of the present abominable system of weights and measures.

In this connection we may refer to the outcome of an incident relating to the metric movement in this country. Last spring a protest issued in the name of the American Society of Mechanical Engineers against the metric bill was widely circulated, the protest being signed by several members of the society well known as unequivocal opponents of the metric system. One of these in an article sent to this journal attacking the system, specifically stated that the protest referred to was issued by the American Society of Mechanical Engineers. In view of the warm favor accorded the measure by mechanical engineers, as expressed in resolutions of some of their representative bodies and in testimony before the committee having the bill under consideration, we expressed at the time our disbelief that the protest conveyed the opinion of the majority of the members of the national professional body. That this surmise was correct was later made evident at the Boston meeting of the society. At this meeting a member took the floor to warmly protest against the action which made it appear that the American Society of Mechanical Engineers was strongly opposed to the introduction of the metric system into the shops of this country, and subsequently a resolution was adopted administering inferentially a stinging rebuke to those who misrepresented the opinion of the society, and ordering that "the present metric opposition committee be excused from further considering the subject before it, and members be appointed thereon who are more in harmony with the customs and practices of this Society.' We refer to this incident for the reason that some may have been deceived by the action thus condemned into believing that the metric bill was viewed with disfavor by the mechanical engineering profession.

State Electric Light Associations.

We have on several occasions referred to the good work being done by the smaller central station associations, the list of which has during the past several years been considerably augmented. While the papers presented at the meetings of these bodies usually contain little of general value from the electrical engineering standpoint, they treat as a rule of matters of live interest to the membership, and together with the discussions, give an indication of the state of development of smaller central stations which otherwise it would be difficult to obtain. Of the 3,500 central stations in this country, probably 2,500 do not have on their staff a professed electrical engineer, and the management is apt to have little touch with current electrical development. The benefit is, therefore, obvious of local associations, at which superintendents and managers may meet to exchange notes, listen to the reading of papers treating of problems of the kind which they encounter, and through the enterprise of manufacturers and supply dealers have brought to their attention the latest improvements in the art. An additional value is frequently given the meet-

ings by the presence of a professor of a State college, who, as a trained expositor, performs a good office in imparting information of practical educational value. It has also become the custom for manufacturing companies to detail members of their technical staffs to prepare papers for such meeting, and while such contributions are naturally ex parte, they nevertheless serve a good end.

One of the latest of these bodies is the Indiana Electrical Association, the sessions of which were recently reported in our pages. Should the standard of the inaugural meeting be kept up, this association will take a high rank among the State bodies; for without aid from the foreign sources above referred to, an excellent programme was successfully disposed of. As at the meetings of most of the State associations, the question of relations with customers was well to the front, and, as usual, flat vs. meter rates received discussion. Flat rates were unanimously condemned, but the difficulties met in educating customers to the equity of the meter were not at all minimized—on the contrary, were shown to form a matter of vital concern. As we recently pointed out, it is one thing to demonstrate irrefragibly the equity of any charging system, but quite another to induce the public to accept the conclusions. In condemning simple methods of charging, the obstacles to better practices are usually ignored; and if these are considerable in passing from flat to meter rates, how much more must they necessarily be in the adoption of the more complicated systems now receiving attention. This is not said in discouragement of efforts to put in practice the several rational systems now being advocated, but once more to direct attention to a side of the question that has been too largely ignored. In the discussions, open arcs suffered badly in comparison with the enclosed types. This but echoes the opinion of similar gatherings of the past several years, and if the open arc still has friends, it is high time that they appeared on the forum.

Alternating-current Railways.

We are glad to note that at last the much-exploited Valtellina railway is in regular commercial operation. It has been for so considerable a period in the experimental stage that we began to fear it had come to some manner of grief not laid down in the programme. Our readers will doubtless recollect that this is the famous Ganz three-phase road, of which so much was heard during the spectacular "Inner Circle," litigation of some months since. In view of the awakened interest in alternating-current motors for traction purposes, the commercial operation of the Valtellina line is of no small importance, and we greatly regret that its location will detract from its value as an object lesson to American engineers. It is a very difficult matter to get authoritative facts about the working of Continental electric railways and transmission plants, for our excellent foreign contemporaries seldom go into such matters in great detail. It is sufficiently obvious from formal beginning of commercial operations that the road is regarded by the Italian Government as thoroughly workable, but it is not the general conditions of operation that are interesting and important to the engineer so much as the special performance of the line in certain important respects. There seems to be no doubt that several of the foreign polyphase roads are in good operative condition, but the vital question is: How far would this condition be satisfactory for suburban and interurban work, judged by American standards? This is a matter not to be determined by papers dealing in general description, nor by casual inspection by engineers who chance upon them in traveling, but by a patient and somewhat protracted study of their everyday operation. The questions that need to be answered are practical ones, touching the performance of the double trolley system, the repairs on controllers and accessories, the problem of speed variation presented in holding to the schedule under more severe traffic conditions and in getting back to it after unusual delays, the average power factor of the system, its working efficiency in watts per car-mile, and so forth.

The Valtellina road is rather the most ambitious and interesting of these polyphase systems on account of its considerable length, and particularly by reason of the concatenated arrangement of the motors, claimed by the engineers to give results comparable with the series-parallel control of direct-current motors. It is the practical substantiation or reputation of this claim that involves the key to the whole situation. Until some alternating motor system, polyphase or other, gains such a power of speed control, any alternating-current railway system must be rather limited in its application. The mere matter of making up time, so as to reorganize a disordered schedule, is of very great practical importance in railway working, and any motor system that has not a reasonably efficient reserve of speed is put at a serious disadvantage. For certain classes of work such a power is of relatively small account, in others it is fundamentally important. One of the chief claims to consideration of the new Westinghouse and Arnold systems is their flexibility in this respect, and the same may be said of the system based on the Ward Leonard method of control, now being brought out by Huber at the Oerlikon works. It is safe to say that any alternating system having really good and efficient speed control will get at least a respectful hearing, and will probably have an immediate field of usefulness. If the Ganz Company has secured what Blathy asserted in his evidence in London, then the Valtellina road should eventually score a success in spite of all the difficulties inherent in the double trolley, which, by the way, seems to be much less feared abroad than here. If we look back over the almost intolerable troubles that the early forms of trolley exhibited in this country, and then contemplate the reliability of the overhead trolley in its present form, we need have small fear of the ultimate result in using a double trolley system.

But this matter of speed control is all important. While it is perfectly true, as we have more than once remarked, that polyphase motors can be varied in speed by rheostats in the secondaries on just the same terms once obtained in the direct-current railway motors, it is notorious that in this latter case rheostatic control is a thing of the past as regards serious undertakings. A thoroughly successful alternating system must embody not only the equivalent of series-parallel control, but lend itelf readily to the multiple-unit control that is at present so important a feature in the larger work of the electric railway. How nearly will the system used on the Valtellina line meet these somewhat exacting requirements? And how, in fact, will any of the systems yet proposed meet them? These are questions which must be answered by experience in actual railway operation, which seem likely soon to be acquired. Of the very material advantages which are given by an alternating distribution we have little need to spark, and we fully realize that they are very inadequately secured by the ordinary distribution to substations with rotaries. With the situation awaiting development, we are heartily glad that American engineers like Messrs. Arnold and Lamme have tackled the problem in dead earnest. With several of Brown's roads in regular operation, the Valtellina line finally open, and Huber at work on the single-phase line of attack, it is high time that we on this side of the water should get into the game. In some form or other alternating current is going to be extensively used in the larger developments of electric railroading, and the more workers the sooner success will come. The roads to be equipped in this country we shall watch with eager interest, and we hope for full and early reports on the various foreign systems. Every bit of experience, successful or not, is valuable to the engineer.

The John Fritz Medal and Banquet.

The eightieth birthday of Mr. John Fritz, the distinguished iron-master and inventor, of Bethlehem, Pa., will be celebrated by a dinner given in his honor at the Waldorf-Astoria, in the ballroom, on Friday, October 31st. This banquet will also signalize the successful founding of the John Fritz Gold Medal, for achievement in the industrial sciences, the medal to be awarded annually by a committee of members of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, and the American Institute of Electrical Engineers.

The organizing committee having the matter in charge on behalf of these various societies has already raised $6,000, representing the contributions of some 500 of the leading members of the engineering professions in this country and in Europe. The medal itself has been entrusted to the American sculptor, Mr. Victor D. Brenner, who has succeeded in designing a medal which is regarded by connoisseurs as a fine piece of work, while the friends of Mr. Fritz speak of it as an eminently vigorous and faithful portraiture. This foundation and the banquet which is to celebrate it have excited the utmost interest in engineering circles, and are an indication of the consideration being given in these flourishing times of the iron and steel industry to the higher aspects of the industrial arts to which those metals are an indispensable necessity. It is understood, moreover, that this is the first time upon which the four great engineering societies have got together for the accomplishment of any such purpose, and there can be no doubt that the award of the medal each year will be considered a distinction of the highest honor. No award of the medal is to be made unless the candidate's name has been under consideration by the Board of Award for at least one year, and it is proposed that this board shall consist of 16 members, four from each society, selected by the governing council of each, to hold office for one, two, three and four years. In case of the non-participation in any year of one of the societies, the award is to be made by the representatives of the remaining societies.

The banquet at the Waldorf will be accompanied by many interesting features and the speakers selected are to respond not only for each branch of the engineering and mechanical arts, but for the Army and the Navy and allied interests. It is worthy of mention that several contributions to the Medal Fund have been received from abroad and that a number of foreign gentlemen will participate in the banquet. The electrical profession and interests are well to the front in the subscriptions to the medal and to the dinner. The tickets for the dinner cost $12, including wine and cigars. Ladies tickets for the boxes, and including a light collation, are being issued at $3, and a large number of them have already been applied for.

Labor and Capital in the Trolley Field.

The sixth anniversary of the Metropolitan Street Railway Association, of New York City, was held on October 4 at the Metropolitan Opera House. The first meeting of the organization was held in a car barn, but at the rate its membership is increasing, Madison Square Garden will hardly be large enough to hold the members and their friends at the anniversary next year. The seating capacity of the opera house was taxed to its utmost. This organization that has grown to such proportions in six years was started by President Vreeland, of the Metropolitan Street Railway Company, solely for the benefit of the company's employees. It is in no sense a charity, and is without official patronage. There are nearly 5,000 members, and they have $12,714 in bank, along with $15,000 invested in the properties the members operate. Every person employed by the company is eligible for membership, and the dues are only 50 cents a month. The organization has its own home and a sick and pension fund. Mr. Vreeland opened the proceedings last night with a most interesting speech, and said:

"This institution which you have organized and supported with your own money and by your individual efforts has attracted universal attention ,and has taught an eloquent lesson. It originated with no other thought than the benefit of its individual members, and its growth and vitality have shown what can be done by a class of men who give exclusive attention to their own affairs. Since the existence of this association questions have arisen more than once involving the relations of capital and labor, and they have been settled amicably and to the perfect satisfaction of both parties to the issue, and without any of the wasteful expense that seems to be unavoidable with others. These frictions with us have left no wounds behind them. In fact, they have done more than anything else to foster and develop a mutual confidence between management and men that is as unique in its way as this organization itself. It has been proven to the men employed on this property that 'the open door' of the management was not a mere name, but an actual fact. That we have been able, without wasteful loss, to adjust our differences becomes very significant when one considers what the history of the last 20 years shows, that contests between capital and labor have cost the men the appalling sum of $257,863,487, and that employers in the same time, as the result of strikes, lost $122,731,121.

"It staggers imagination to consider what might have been wrought by the application of this princely sum, wasted so wantonly, if it had been applied to such ends as those to which we apply our little mite. In my opinion this great waste is the result of the failure of mutual knowledge between employers and their men. As this necessary knowledge can only come from acquaintanceship, and as associations like this promote and foster intercourse, it is to be regretted that other workers do not view the situation as we do. How can men, whether they are capitalists or laborers, expect to understand each other if they are not acquainted? Without acquaintanceship there must be as much ignorant suspicion on one side as on the other. Nothing inspires more fear and distruct than half understood and wholly unseen things. I am no prophet, nor have I at hand data to prove the assertion, but it seems to me that if all these difficulties—and there were 22,793 of them—had been left to the employers and employees, without outside interference, they would have been adjusted without this horrible waste, and would have tended to a narrowing instead of a widening of the breach between the men and their employers.

"All told, there are more than 17,000 of us in this community, and as it is true that every one of us helps to support at least five persons, it will be seen that in the life of this greatest metropolis on the western hemisphere, we are no insignificent factor."

This address, of which part is quoted, was followed by a remarkably good vaudeville show, which lasted till midnight.

Metric System in Great Britain.

Cónsul-General H. Clay Evans sends from London, August 30, 1902, a letter from the secretary of the Decimal Association, showing the progress of efforts to have the metric system of weights and measures adopted in England. The letter says:

"It has come to my knowledge that there is a considerable feeling in favor of the adoption of the metric weights and measures in the United States of America, and with this in mind, I am sure that you will be interested in information regarding the prospect of this country adopting metric weights and measures also. I therefore venture to lay before you the following information:

"There are 290 members of the present House of Commons so thoroughly in accord with our aims that they have given me authority to publish their names as supporters. If we add to this the number of members of Parliament who would be influenced by a debate in the House of Commons to vote in our favor, we are convinced that we are now strong enough to carry a bill. During the last four or five weeks, no less than 60 city, town and county councils have passed resolutions to the effect that it is desirable that the reform should be made in the interest of commerce and education.

"One of the most definite results, in fact, I think I may say, the most definite result, of the conference of the colonial premiers was the passing of a resolution in favor of the adoption of the metric weights and measures throughout the British Empire. This will have a most important result, and will render certain the early passing of a bill to give effect to those views. All the chambers of commerce in this country, nearly all the school boards, the trades unions, and a great number of societies of various kinds have for a long time been active supporters of my association.

"The attitude of our Premier may be gathered from some remarks he made to the deputation which waited upon him in rgard to this question in 1895. He said: 'If I may express my own opinion upon the merits of the case, there can be no doubt whatever that the judgment of the whole civilized world, not excluding the countries which still adhere to the antiquated systems under which we suffer, has long decided that the metric system is the only rational system.'"

ONE OF THE SUBSTATIONS.

Long Transmission From a Steam Station for Electric Traction.

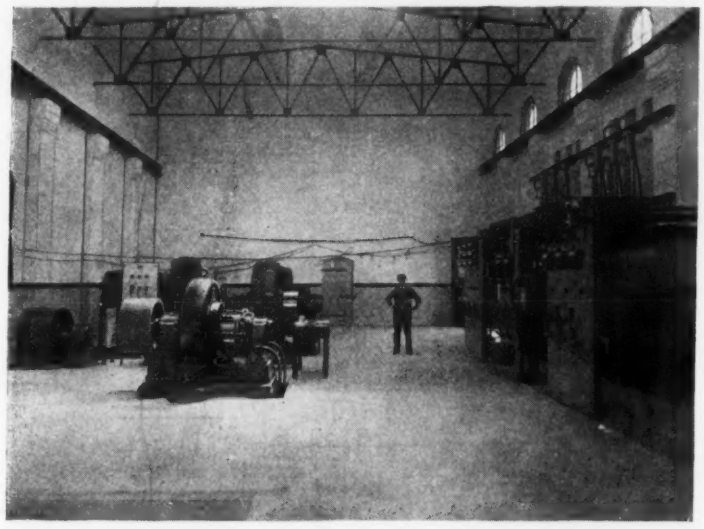
PORTSMOUTH, New Hampshire, is the site of a generating station that operates electric cars in Nashua and Rochester, 75.5 miles apart. Coal comes to this station by tide water, and its energy is transmitted 25.5 miles to the north, along the Maine and New Hampshire boundary line, to Dover and Rochester. To the south the line passes through the Hamptons, touches Exeter, skirts the New Hampshire beaches, reaches the Merrimac River at Amesbury, turns up the valley to the west, enters Haverhill, Lawrence and Lowell on the way, and ends at Nashua, 50 miles from the Portsmouth station.

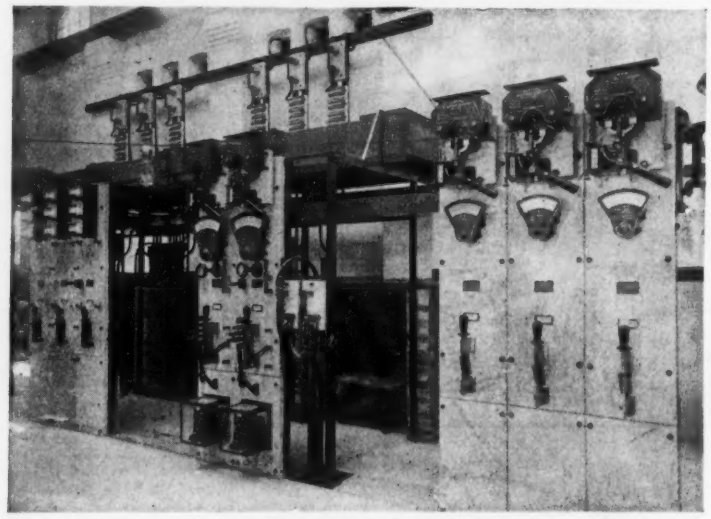
The main purpose of this notable system is to operate electric car lines between all of the cities named, through many smaller places, to a pleasure resort at Canobie Lake, and along the short but celebrated sea coast of New Hampshire. The minor purpose of the system is the general distribution of light and power in Portsmouth, Exeter, Hampton and other points where it may be desired. This generating station, transmission system, electric railway lines, pleasure resorts and lighting equipments are owned by the New Hampshire Traction Company.

Portsmouth, the only seaport of New Hampshire, furnished the most desirable site for the steam generating station, because the high railway charges for the transportation of coal could be then avoided. But this location of the main station implied a high voltage of transmission because the more distant end of the system is 50 miles away, half across the State. Accordingly the energy for transmission leaves the generating station at 13,200 volts. A part of this energy passes north to substations at Dover and Rochester. The other part goes south and west to substations at Stratham, Hampton, Hampton Beach, Amesbury, Plaistow, Salem and Pelham. From the Portsmouth plant to the Rochester substation, the more distant one to the north, the transmission line has a length of 23.52 miles.

Between the Pelham substation, which marks the end of the high-tension transmission on the west and the generating station, the distance by line is almost exactly 42 miles. This distance probably represents the longest electrical transmission at high voltage in New England. Feeders and trolley wire at 500 to 600 volts extend the transmission two miles beyond the substation at Rochester, and to Nashua, eight miles west of the Pelham substation. The total length of line operated at 13,200 volts between Dover and Pelham. by way of Portsmouth, is 65.5 miles, and branch lines to Stratham, Amesbury and Hampton Beach raise this total to 80.3 miles of high-tension transmission. Throughout the greater part of its course, this 13,200-volt line does not follow the tracks of the railways it is designed to feed, but takes, as a rule, the shortest course across country from one station to another. A result of this plan is that a great part of the high-tension line is run over private land. To convey the rights on such lands to set and maintain poles, string wires, transmit electric currents, and cut away all trees and branches that come within one rod on either side of the line, forever, there has been prepared and used a uniform, printed deed, suitable blank spaces being left for the necessary insertions in each case. The easements conveyed by the deed are very fully set out, and it is evidently designed to prevent future litigation. All of the 13,200-volt line, except about two miles of that entering the Amesbury substation, is in New Hampshire. Poles for this line are of Connecticut chestnut, and their most common length is 35 feet, though other lengths are used where more suitable. Over the entire 80 miles of line, the standard distance between poles is 100 feet. Every pole is numbered, and a drawing to scale shows its exact location. The line is especially well guyed, and all the poles are painted.

Two-pin and four-pin cross-arms have been used for the 13,200-volt lines. On the four-pin cross-arms the pins are spaced 15 inches apart at each end, and this is the standard distance apart throughout the system for the three conductors that go to make up each three-phase line. The greater part of the three-phase circuits are arranged in the triangular form by placing one conductor at one end of a two-





FIGS. 1 AND 2.—INTERIOR OF SUBSTATION.

pin arm, and the other two conductors underneath at one end of a four-pin arm. Standard locust pins are generally used for the high-tension lines, but at corners and where these lines turn to enter the substations composite pins are employed. Each of these pins consists of an iron bolt 10½ inches long, ½ inch in diameter, and with a thin flat head. A piece of wood corresponding to the top of a pin, and two inches long, fits over this bolt next to the head, and is threaded to receive the insulator. Next to this wood comes a porcelain sleeve, 3 inches long, that rests on the cross-arm. The bolt passing down through the porcelain sleeve and the cross-arm is secured underneath by a nut. The cross-arms are all provided with two iron braces each.

Vitrified porcelain insulators are used to support the entire transmission line. These insulators are all provided with both top and side grooves, so that the conductors can be mounted in either position, and both methods of mounting have been employed. Insulators vary in size to adapt them for the various conductors used in the transmission. One of the large insulators is 6¾ inches in diameter at its largest point, 4 inches in diameter at the rim above the side

FIG. 3.—MAP OF THE RAILWAY SYSTEM.

groove, 4¼ inches high from the lower rim to its top, has a top groove of 1⅛ inches diameter, and a sleeve that surrounds the pin to a distance of 1½ inches down from the lower rim. The height of this insulator when set upright on this sleeve is 5¾ inches.

The 13,200-volt conductors are bare, except a short stretch in Portsmouth, from Rochester to Nashua, a small part of them are aluminum, but the greater part is copper. Nine substations are supplied by the high-tension, three-phase lines, and the general plan of their arrangement is to decrease the number or size of conductors at each substation as the distance from the generating plant increases.

From the generating plant at Portsmouth three No. 2 copper wires connect with the Dover substation, a distance of 16.78 miles. These No. 2 wires are replaced by a submarine cable of three No. 6 copper wires crossing Great Bay, an arm of the ocean between Portsmouth and Dover. The length of this cable is about one mile. From the Dover to the Rochester substation, a distance of 6.74 miles, the 13,200-volt line consists of three No. 6 copper and three No. 6 aluminum wires. Starting again from the generating plant in Portsmouth six No. 3/0 wires extend to switch houses at a steam railway-crossing, distant about three and one-half miles. From this crossing the line of six 2/0 copper conductors continues south to the Hampton substation, distant 11.11 miles from the plant at Portsmouth. At a point about six miles from the Portsmouth plant, three No. 2 copper conductors connect with either set of the 2/0 wires, and run thence to the substation at Stratham, a distance of about 7.9 miles from the junction of the circuits just named. From the Hampton substation three circuits go south. One circuit of three No. 2/0 copper wires runs to the substation at Plaistow, a distance of 16.56 miles. Two other circuits, each made up of three No. 6 aluminum wires, run side by side to the Amesbury substation, distant 8.16 miles from that at Hampton. At a junction point on this aluminum line, 5.77 miles from Hampton, three No. 4 copper wires connect to either set of three wires, and extend 8.02 miles to Hampton Beach. Between the substation at Plaistow and that at Salem, a distance of 7.78 miles, the 13,200-volt line consists of three No. 0 copper conductors. Three No. 2 copper wires extend the transmission line, 6.49 miles from the substation at Salem, to the one at Pelham, which marks the end of the high-tension system, 41.94 miles from the Portsmouth station.

Where the transmission line from Portsmouth to Dover crosses Great Bay, into which flows the Piscataqua River, the submarine cable joins the overhead wires at each end in fire-proof terminal houses. Each of these houses is brick, on a foundation of concrete, and has a roof of vitrified tile or slate laid in cement and supported by steel T's that rest on the brick walls. The concrete foundation extends 5 feet below the ground surface, and the floor is formed by one inch of Portland cement resting on 3 inches of concrete, and this in turn on 8 inches of cinders. Each house is 6 x 8 feet at the floor level inside, and 12 feet 9 inches from the floor to the lowest point of the roof. The walls are 13 inches thick, of hard brick in red cement mortar.

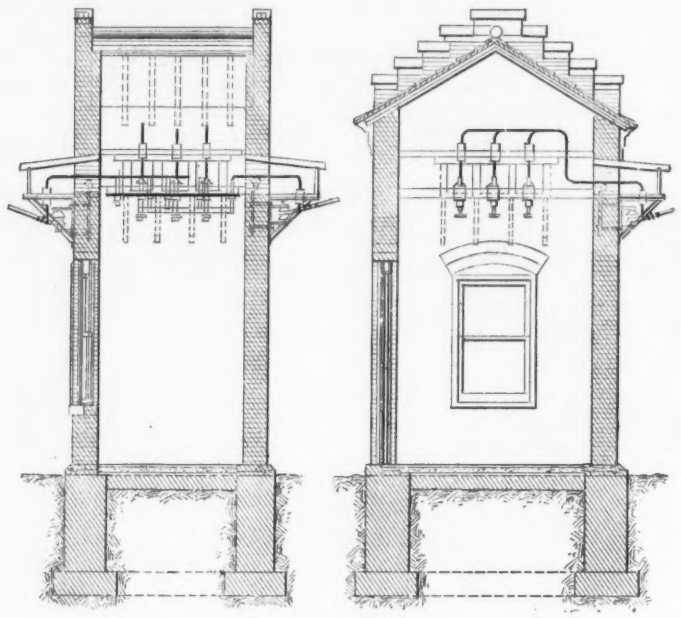


FIG. 4.—SECTIONAL ELEVATIONS, TRANSFER SWITCH HOUSE.

The overhead wires carrying 13,200 volts enter each terminal house 10 feet 8 inches above the floor, and these wires are 10 feet above the ground outside. Entry of the overhead lines is made through a form of outlet designed by the General Electric Company, and to be described in detail later. The lead-covered submarine cable passes through the foundation of each house at about 4 feet 3 inches below the floor level, and extends up the side, having an outlet at a point 8 feet 9 inches above the floor, where the three conductors separate and pass to the porcelain supports at the outlet which are spaced two feet apart. Just back of each of these supports a tap passes from the line conductor to a knife switch and series of lightning arresters mounted on a frame of 4-in. x 4-in. white pine. The three series of lightning arresters are joined to a common ground plate, and between the series are placed slabs of slate, each 1 in. x 24 in. x 7 ft. 10 in.

Where the transmission line, connecting the generating plant at Portsmouth with the Hampton substation, crosses the tracks of the Boston and Maine Railroad, in Portsmouth, a switch house similar to that just described has been erected at each side of the right of

way, and the conductors pass from one house to the other underneath the tracks.

At the junction of the Stratham line with that passing from Portsmouth to Hampton, a transfer-switch house, similar to the above in general construction, has been erected, and the same is true at the junction of the line running to Hampton Beach with that which connects the substation at Hampton and Amesbury. In the case of each of these transfer-switch houses, however, there is no underground cable, but overhead lines enter on three sides of the house. At two sides enter the two circuits of three wires each, either of which can be connected to the third circuit which is to receive energy, by means of the transfer switch. The third circuit enters at the remaining side and can be operated when either of the other two is connected to the transmission system. The 13,200-volt lines enter these transfer-switch houses at about 10 feet 6 inches above the ground level.

Not only is it possible to disconnect each set of three conductors leaving the generating station from the switchboard there, but oil switches at the substations give each of them control of all the transmission line beyond it. Thus at Dover the 13,200-volt line that extends to Rochester may be disconnected from the high-tension system by throwing a single oil switch. At Hampton, one oil switch will disconnect the three No. 2/0 wires that run to Plaistow, and another oil switch will cut-out the six aluminum conductors extending to Amesbury. In a similar way the energy may be cut off from both the Salem and Pelham substations by an oil switch at Plaistow, or from Pelham only by the switch at Salem. Every high-tension conductor entering a substation passes at once to a knife switch, which may be opened after the conductor has been disconnected from the source of energy by an oil switch.

At the station side of each knife switch two connections are made, one going to a series of five lightning arresters, and the other to an oil switch mounted in a compartment of brick and stone behind the switchboard panels. The several series of lightning arresters are joined to a common ground plate in each case. The nine substations above named are all similar as to the character and connections of the equipment that receives and converts energy from the 13,200-volt line. At each station the received energy after passing through the oil switches goes to transformers that reduce the voltage from 13,200 to 380 for the rotary converters. The transformers now installed and in operation number 45, with a combined capacity of 5,010 kilowatts. Of these, six are rated at 100, twelve at 120, and twenty-seven at 110 kw each. All of these transformers are of the air-blast type, and at each substation one or more blowers, direct connected to electric motors, are provided to give the air blast of 3/8-ounce pressure which the transformers require. In connection with the double-throw switch which joins each rotary to its bank of three transformers is a reactive coil for use in starting the rotary. The reactive coil used with each 300-kw rotary is rated at 540 amperes and 28 volts, and for 350-volt circuit.

The nine substations contain 15 rotary converters, all three-phase at 25 cycles per second, and rated to deliver direct current at 600 volts. Three of the rotaries are rated at 250 kw each, and the other twelve at 300 kw each, giving a total capacity of 4,350 kw. Each of the 300-kw rotaries has six poles, six sets of brushes, and operates at 500 r. p. m. Three collector rings receive the alternating current at each rotary through copper leaf brushes, and distribute it to the armature coils through nine radial connections that enter the coils at equidistant points. The switchboards at substations are in each case provided with energy from the 13,200-volt line for indicating instruments through a small transformer designed for the purpose. These instruments include a volt meter, at which the indication of 110 corresponds to 13,200 volts on the line; an ampere meter, and a power factor indicator, with range from 90 to 100, for each three-phase circuit. The energy output of each rotary in the form of 600-volt, direct current, is measured by a recording wattmeter. This energy then passes to feeder panels and out of the substation. At one substation, that at Salem, a booster generator with capacity of 400 amperes at 250 volts is provided for use in one of the 600-volt feeders. This booster has six poles, and operates at 550 r. p. m. On page 572 is a list of the apparatus at each of the substations.

Fig. 5.—Hampton River Bridge—Length, 4,623 Feet.

Each of the 16 blowers is driven by a 1-hp motor, direct connected; three of these motors operate with direct current, and 13 motors are of the induction type.

The portable substation is contained in a box-car, 30 feet in length, and of about the usual freight-car construction. During the summer this car has been at Hampton Beach, but it will shortly be taken to Rochester to provide additional capacity there during the coming fair, and can be moved to any part of the system.

These nine substations are devoted exclusively to the operation of the electric railway of the New Hampshire Traction Company. This street railway system has a total length of about 132 miles, of which more than 100 miles is now in operation and the remainder is nearing completion. The line connects the cities of Dover, Somersworth and Rochester, and from Nashua forms a continuous road through the busy Merrimac Valley to Portsmouth, the only seaport of the State of New Hampshire. Between these terminal points the main lines passes through Exeter, Hampton, Plaistow, Salem, Pelham, in New Hampshire, and Amesbury and Haverhill, in Massachusetts. Connecting with this through line are branches to Hampton Beach, a line between Haverhill and Lawrence, Lawrence to Canobie Lake and to Pelham, and from Lowell to Pelham. The Traction Company thus connects and draws its traffic from the four large cities of the Merrimac Valley, Haverhill, Lawrence, Lowell and Nashua, and gives them a direct outlet to a seaport and to several beaches

of the Atlantic coast. The private right of way is located as follows: Between Nashua and Pelham, 5.75 miles; between Pelham and Salem, 5.25 miles; between Pelham and Lowell, 1.00 miles; between Pelham Junction and Lawrence, 1.75 miles; between Lawrence and Canobie Lake, 4.50 miles; between Haverhill and Lawrence, 2.75 miles; between Haverhill and Amesbury, 4.00 miles; between Amesbury and Hampton Beach, 2.00 miles. The total length of railway on private way is thus 27 miles, and this has been graded, ballasted and provided with masonry culverts in a way similar to the practice on steam roads. Fifty feet is the standard width of this private right of way, and the company has purchased it in fee. Several bridges crossing the tracks of steam railways and a small river have been built for the electric system Between the northern and southern portions of Hampton Beach is the Hampton River, an arm of the sea, nearly a mile wide at this point. In the past a detour of about five miles around the mouth of this river has been necessary in order to pass from lower Hampton or Salisbury Beach to the main part of Hampton Beach. A wooden, pile bridge across this river, one mile in length and with a draw, has been constructed by the electric railway company for the use of its cars and as a toll-bridge for the general public. This is, perhaps, the longest bridge ever built for an electric railway. Pile bents under the bridge are 12 feet apart, and there are 14 piles to each bent. The toll over the bridge is five cents for each person or vehicle crossing it. At Canobie Lake, which is about eight miles from Lawrence and nine from Haverhill, the electric railway system includes a park of 35 acres, with a frontage of about 1,000 feet on the Lake. Suitable buildings for recreation purposes have been erected in this park, and it has become an attractive and easily reached resort.

Station	Transformers No.	Transformers each K.W.	Rotaries No.	Rotaries each K.W.	Reactive Coils. No.	Reactive Coils. each Volts
Rochester	3	100	1	250	1	28
Dover	6	110	1	250	2	28
			1	300		
Stratham	3	110	1	300	1	28
Hampton	6	120	2	300	2	28
Amesbury	6	110	1	250	2	28
			1	300		
Plaistow	6	110	2	300	2	28
Salem	6	110	2	300	2	28
Pelham	6	120	2	300	2	28
Portable	3	100	1	300	1	28

Station	No. of blowers	Type of motor	No. of feeder panels	Amperes each
Rochester	1	D.C.	2	600
Dover	2	A.C	3	600
Stratham	2	A.C	3	600
Hampton	2	A.C	3	1200
Amesbury	2	A.C	2	1200
Plaistow	2	D.C	2	1200
Salem	2	A.C	4	1200
Pelham	2	A.C	4	600
Portable	1	AC.	600 ampere circuit breaker.	

During the past five months about 85 miles of new track have been added to the system of the New Hampshire Traction Company, and the remainder of the line is made up of previously existing roads. In city streets the construction has been carried out with 9-inch, 90-pound per yard girder rail. Outside of the cities a T-rail of 70 pounds per yard has been mainly used. The entire length of track is double bonded with 4/0 bonds, one bond being placed inside and one outside of the fish plate. No return conductors aside from the rails are provided. The length of rails mainly used is 60 feet.

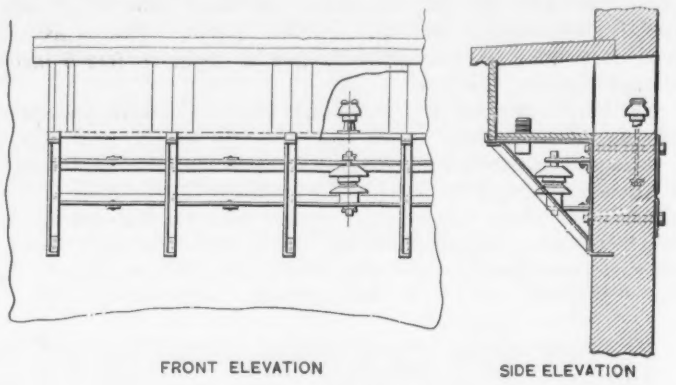


FIG. 7.—LINE ANCHORAGE.

All of the new track has been laid on chestnut ties, each 6 in. x 8 in. x 7 feet, spaced two feet apart on centers, and ballasted with one foot of gravel. On all the new line a No. 2/0 hard copper trolley wire has been erected, mostly on side brackets, though some center construction has been put up in cities and elsewhere. Chestnut poles have been used throughout, generally 35 feet each in length. These poles all carry the trolley-wire feeders and telephone lines in addition to the brackets for the trolley wire. The United States block signal and telephone system is used over the entire line.

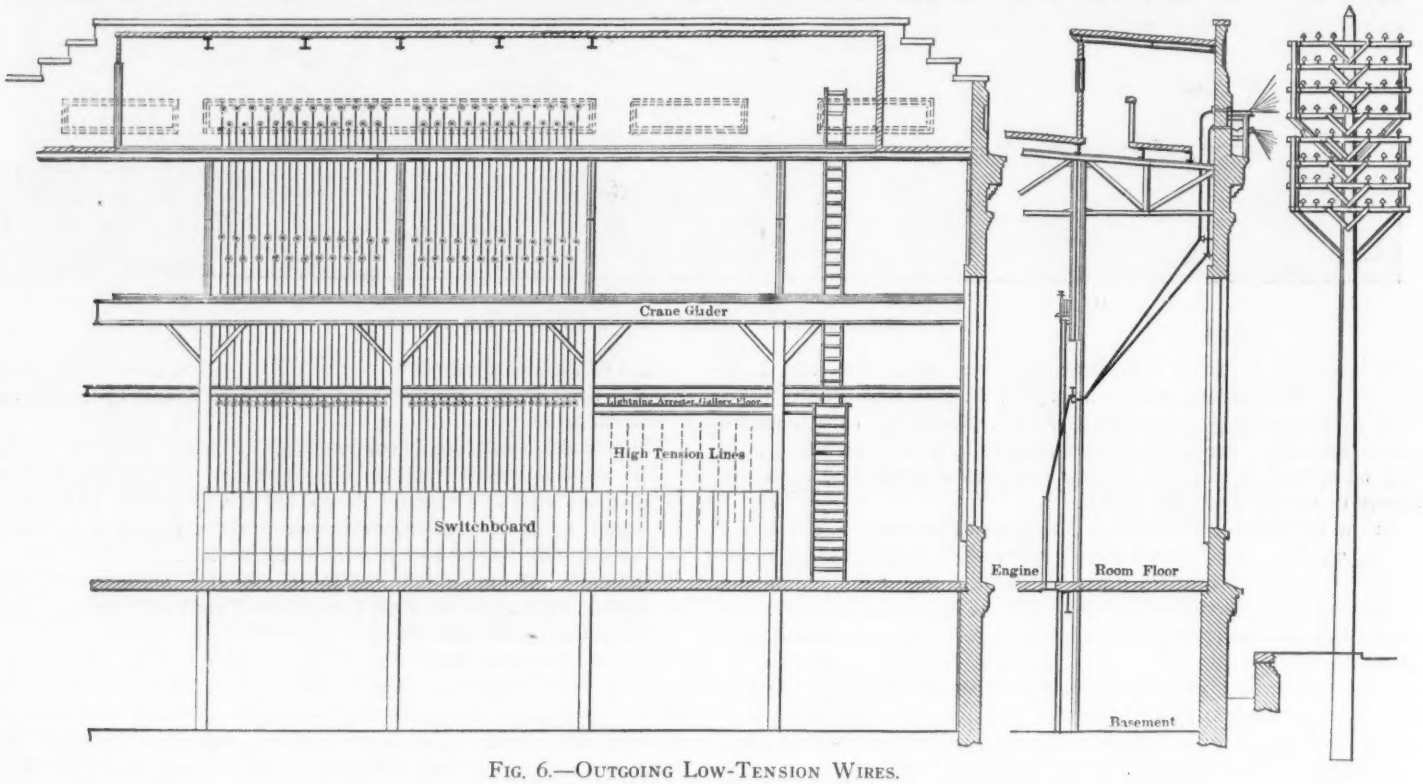


FIG. 6.—OUTGOING LOW-TENSION WIRES.

Heavy feeders of weatherproof, insulated wire connect the substations with each other and with the trolley wire. The rule with

these feeders is to follow the track, join all the feeders on a particular line, so that they form one conductor, and connect first one feeder and then another to the trolley wire at short intervals. Between the Dover and Rochester substations there are two feeders each of 500,000 cm. From the Dover substation to Dover City there are three No. 2/0 feeders, and two feeders of No. 2/0 follow the tracks from the same substation to Somersworth. Between the generating plant at Portsmouth and the substation at Stratham two No. 3/0 feeders are run, and others of the same size continue on to Exeter, where they are met by two feeders of No. 4/0 from the substation at Hampton. From this same substation three No. 4/0 feeders pass over the line to the northern portion of Hampton Beach, and two feeders, mostly of the same size, go to the Amesbury substation, one being of 500,000 cm., for 2.5 miles south of Hampton. At Smithton these two last named feeders are joined by a single 4/0 that goes to the southern portion of Hampton Beach and crosses the long bridge over the Hampton River to join the feeders from the north. Between the Amesbury and Plaistow substations there are two No. 4/0 feeders for the trolley wire, and they continue from the latter station to Haverhill. The Salem substation sends out a 500,000 cm. along the track toward Haverhill, and this changes to a No. 4/0 where it joins the direct line between Haverhill and Lawrence, which has a 4/0 feeder running its entire length. Two feeders of 375,000 cm. each extend from the Salem station to Lawrence, and a third feeder of 350,000 cm. goes from the same station to the junction in Methuen, where it changes to a 4/0 and follows up the Lawrence and Methuen line to join the 4/0 feeder that joins the Salem and Pelham substations. This latter station sends out one pair of 4/0 feeders to Nashua, and another pair of equal size to Lowell, thus completing this extended system of 600-volt feeders that reaches from Portsmouth to Nashua, and with its branches follows more than 100 miles of track.

The first substation to receive energy from the Portsmouth plant was that at Hampton, which was connected to the 13,200-volt line from Portsmouth on August 8, and began to operate with the transmitted energy on August 9, 1902. Prior to this time a part of the substation had been operated from a smaller generating plant at Hampton. On Sunday, September 14, 1902, the direct-current outputs of some of the substations in kw-hours were as follows: Stratham, 3,120; Plaistow, 2,640; Hampton, 2,160; Amesbury, 2,040.

The rolling stock of this system includes about 140 cars, of which the greater part, approximately 100, are either the 14-bench open or

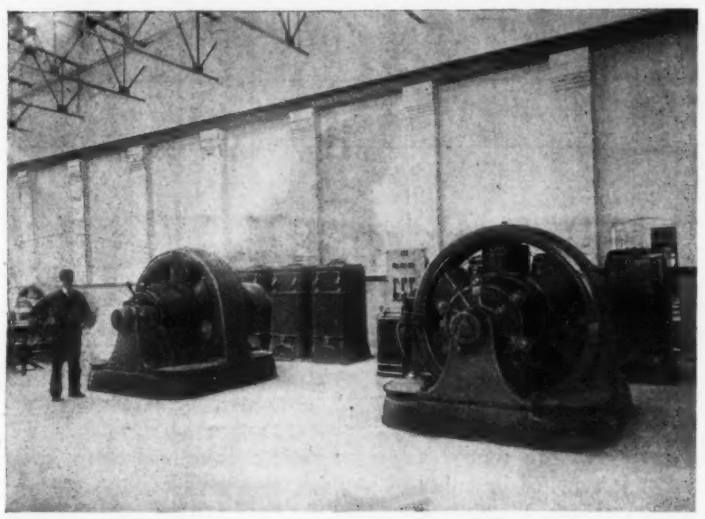


FIG. 8.—INTERIOR OF SUBSTATION.

the 30-foot enclosed type, fitted with air brakes. Running time and passenger fares over the greater part of this system are as follows: Nashua to Haverhill—time, 1½ hours; fare, 25 cents. Haverhill to Canobie Lake—time, 45 minutes; fare, 10 cents. Haverhill to Amesbury—time, 1 hour; fare, 15 cents. Haverhill to Lawrence—time, 45 minutes; fare, 10 cents. Amesbury to Hampton Beach—time, 45 minutes; fare, 15 cents. Amesbury to Exeter—time, 1 hour, 15 minutes; fare, 15 cents. Exeter to Portsmouth—time, 1 hour; fare, 20 cents.

The car barns connected with this electric railway, like the substations buildings, of which they form a part in most cases, are one story in height and of brick and steel construction with concrete floors. The locations of these car barns and their capacities in cars are: Amesbury, 16; Plaistow, 12; Stratham, 14; Hampton, 34; Salem, 36; Pelham, 32; Dover, 12, and Rochester, 12. In the building that forms the car barn and substation at Salem, there is also a machine shop to handle the repair work of the system.

Lighting and the distribution of power to stationary motors forms an important though minor part of the business of the New Hampshire Traction Company. Electric lighting is at present done in three places—Portsmouth, Hampton and Exeter. The lighting in Hampton and Exeter is done at present by a generating plant in the former place, but this plant will be replaced later by substation equipment operated with energy from the Portsmouth plant.

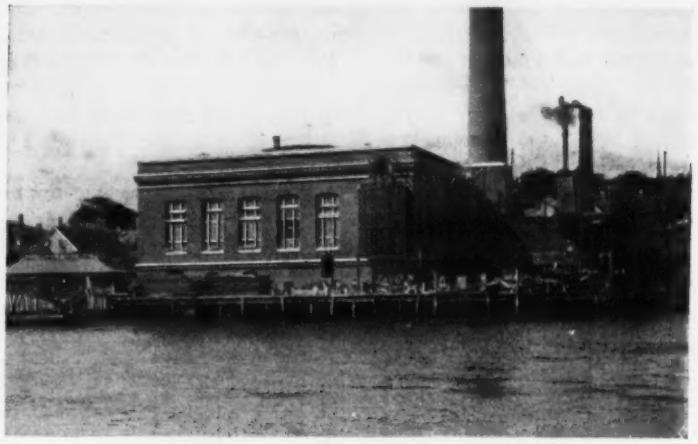


FIG. 9.—PORTSMOUTH GENERATING STATION.

The lighting load in Hampton and Exeter includes 77 enclosed alternating arcs, taking 6.6 amperes, 45 series incandescent lamps of 32 cp each, on the arc circuit, and about 1,600, 16-cp incandescent lamps. To carry this load of lamps a three-phase alternator of 150-kw capacity, at 600 r. p. m., 2,350 volts and 60 cycles per second, is operated by a belted engine in the Hampton plant. Connected to this alternator is a constant-current transformer, rated at 58 kw and 6.6 amperes, and used for the arc circuit.

Besides this lighting equipment, the Hampton plant contains direct-current generators of 350-kw capacity, at 600 volts, also a 500-kw, three-phase, 25-cycle, 13,200-volt alternator, at 107 r. p. m., direct coupled to a horizontal, compound engine. Both the direct and alternating generators last named have been used for several years to operate portions of the electric railway system previously described. From now on these Hampton generators will be operated merely as an auxiliary to the Portsmouth plant.

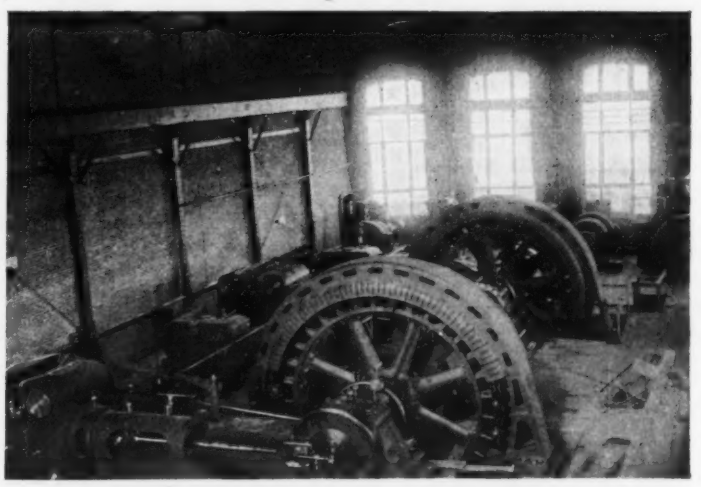


FIG. 10.—PORTSMOUTH GENERATING STATION.

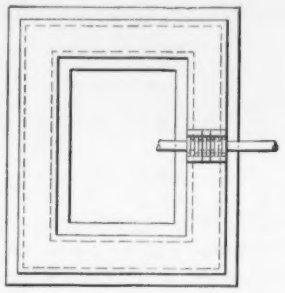
At Portsmouth the local service includes gas supply as well as electric light and power. All of this service is carried out, and the Portsmouth generating station operated by the Rockingham County Light and Power Company, one of the corporations that go to make up the new Hampshire traction system.

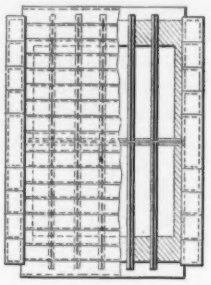
Coal gas enriched with oil is supplied at Portsmouth, and its candle-power is about 18. During the past year the output of this gas has

been about 14,000,000 cubic feet, but this amount is being rapidly increased by the introduction of gas stoves.

About 20,000 16-cp and 230 25-cp incandescent lamps, and 120 enclosed arc lamps are now connected to the distribution system at Portsmouth. The arc lamps operate with 6.6 amperes, and with the 25-candle incandescent lamps are used for street lighting. The 25-candle lamps take 1.75 amperes at 50 volts, or 88 watts, and are used in large Edison bases, connected in series. For the series circuits of these 50-volt incandescent lamps the alternating voltage of 2,300 is steped-up to 4,000 volts, and a General Electric reactive coil is connected in each circuit to hold the current at 1.75 amperes. Enclosed arcs are operated by two constant-current tub-transformers, each rated at 6.6 amperes and 6,000 volts, and connected to a separate circuit. These tub-transformers and those for the incandescent street lamps draw their energy from two-phase generators at 2,300 volts. The local distribution lines for incandescent lighting are also connected to the 2,300-volt, two-phase generators.

A load of direct-current motors in Portsmouth is provided for by a rotary converter of 150 kw and 550 volts at the new generating station. This rotary takes its energy from transformers that step-down the primary voltage of 13,200 to 370.





Service to large stationary motors at Portsmouth is available through transformers that step the 13,200-volt energy from the main generators down to 550 volts at 25 cycles, three-phase.

The local distribution of electric light and power from the main generating station is thus carried out through five classes of circuits.

One set of circuits for both arc and incandescent lighting is two-phase, four-wire and 60 cycle, at 2,300 volts. Arc circuits for series lamps are two-wire, 60-cycle, single-phase, 6.6-ampere and 6,000-volt. Incandescent street lamps are operated by two-wire, 60-cycle, single-phase, 1.75-amperes and 4,000-volt circuits. Two-wire, direct-current power circuits at 550 volts supply energy to direct-current motors in general use.

These various distribution circuits make up a total of 46 wires which pass from the switch panels directly to the brick wall at one side of the station, and then out through 40 porcelain tubes, each 16 in. x 1 in., and 6 tubes, each 16 in. x 1½ in., to poles carrying eight cross-arms with six pins each. The porcelain tubes are arranged in two rows, one row being 18 inches above the other, and the tubes are on 15-inch centers in each row. All wires are attached to a special bracket, fixed to the face of the brick wall, before passing to the pole.

Energy at 13,200 volts, 25 cycles, three-phase, that operates at once electric cars in Nashua 50 miles away, and the synchronous motor in the Portsmouth station is supplied by a pair of main generators.

Each of these generators is rated at 1,000 kw, 13,200 volts, three-phase and 25 cycles, at 94 r. p. m. A cross compound, horizontal engine, with cylinders 28 in. x 54 in. x 48 in., is direct connected to each of these main generators. These generators are of the revolving-

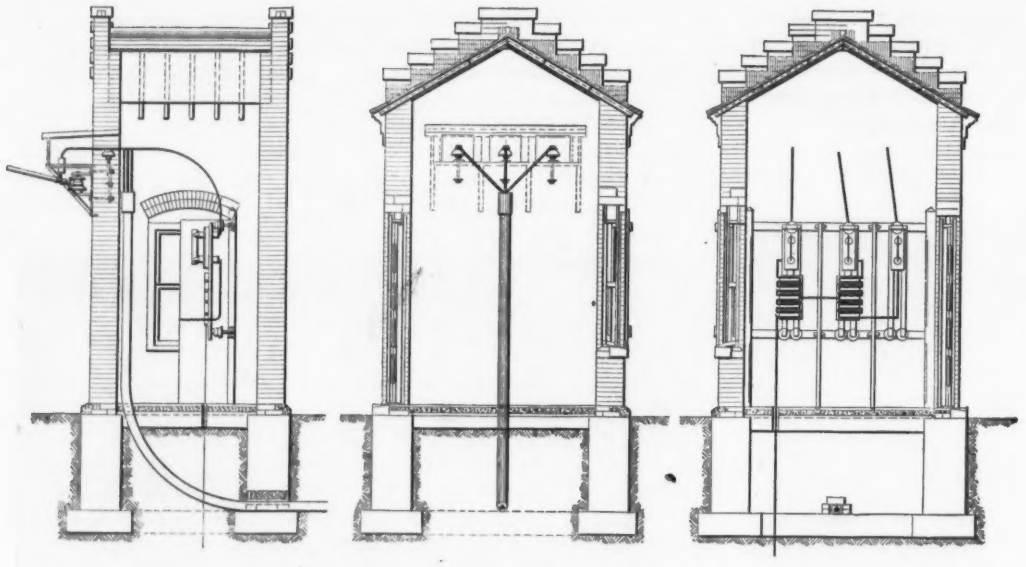


FIG. 11.—PLANS AND SECTIONS, CABLE TERMINAL AND LIGHTNING ARRESTER HOUSE, PISCATAQUA RIVER CROSSING.

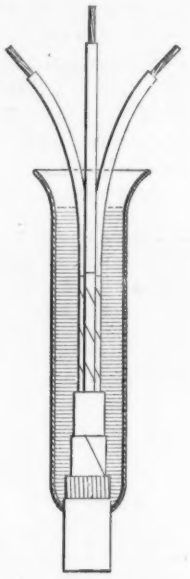


FIG. 12.—TERMINAL BELL FOR HIGH-TENSION CABLES.

Two generators have been installed at the Portsmouth station for electric lighting, and service to stationary induction motors. Each of these generators is of 200-kw capacity, 2,300-volt, two-phase and 60 cycles. One of the generators is direct connected to a compound, single-acting, vertical engine, with cylinders 18 in. x 30 in. x 16 in., and operate at 233 r. p. m. The other 200-kw generator is direct connected to a synchronous motor, and operates at 500 r. p. m. This synchronous motor is rated at 300 hp, and is driven by current from three transformers of 80-kw each that step-down the voltage from 13,200 to 2,300, 25-cycle, three-phase. An exciter for this motor-generator set is mounted on an extension of its shaft, is rated at 60 volts and .166 amperes, and has 8 poles. For the steam-driven 200-kw generator, an exciter rated at 20 kw and 125 volts is provided. This exciter is direct connected to a 30-hp, two-phase, 60-cycle induction motor, and operates at 900 r. p. m. This motor is supplied by two transformers of 15-kw each, that step-down from 2,300 to 230 volts, two-phase.

magnet type, with contact rings for their exciting currents. This current is supplied by either of two dynamos, each rated at 100 kw and 125 volts. A vertical compound, single-acting engine, with cylinders 12 in. x 20 in. x 12 in., is direct connected to and drives each of these exciting dynamos at 300 r. p. m. Besides the two generators of 1,000-kw each now in operation, a third generator is now on order, which will have a capacity of 2,000 kw at 13,200 volts, three-phase and 25 cycles. This 2,000-kw machine will be direct connected to a compound, vertical engine, with cylinders 38 in. x 76 in. x 54 in., and operated at 83.3 r. p. m.

As the main generators develop 13,200 volts, the normal pressure used on the transmission system, in their armature coils, no step-up transformers are required. From each main generator the three cables carrying current at 13,200 volts are carried in vitrified conduits down and under basement floor to the oil switches near the back of the switchboard panels. This switchboard is in itself a notable piece of work. From the basement floor

bus-bar compartments rest, to the top of the lightning arresters and knife switches in the gallery above the main floor is a distance of 33 feet. There are 36 switch panels with a width side by side of 48 feet. The three 13,200-volt bus-bars of bare copper strip are mounted on porcelain in a series of brick and stone compartments, built up from the basement floor to a height of seven feet. Each compartment is ordinarily closed, so that the bus-bars are covered on all sides. Oil switches for the 13,200-volt generators and for the feeders at this pressure are mounted in cells of brick and stone, built up from the main floor behind the switch panels. On the top of this cell structure are the motors that operate the oil switches. Connected with each motor is an automatic overload relay which starts the motor, so as to open its switch in case of an overload on the feeder circuit concerned. This arrangement adds to the usual action of an oil switch the function of an automatic circuit breaker. Each generator panel carries volt and ampere meters, a power factor indicator, Lincoln synchronizer, and indicating and recording wattmeters. Each feeder panel carries three ampere meters and two recording wattmeters. Three 13,200-volt, three-phase sets of feeders pass from the oil switches to the tower for high-tension lines at the top of the building, making a total of nine wires, of which six go to the Hampton and three to the Dover substation. At the gallery level, a connection brought down from each 13,200-volt feeder wire

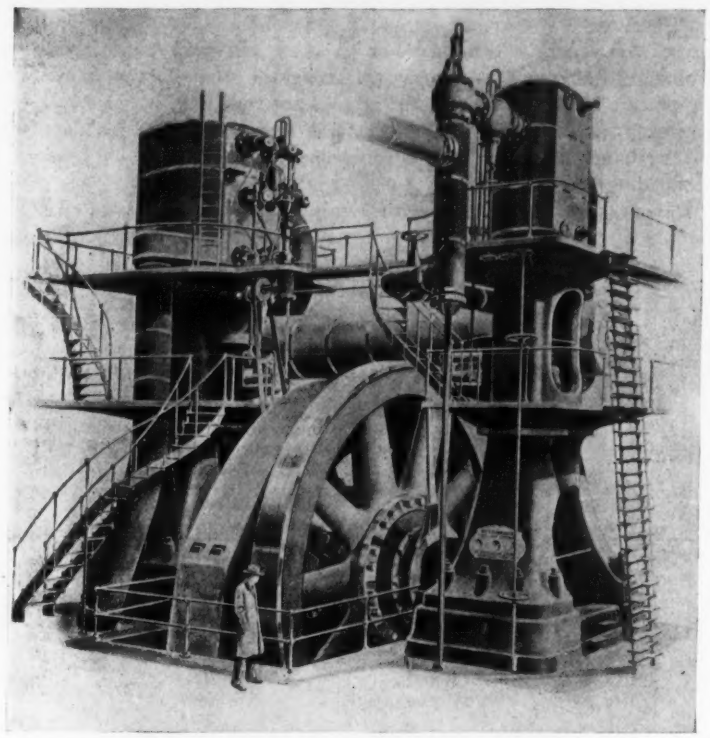


FIG. 13.—THE NEW 2,000-KW GENERATOR.

passes into a knife switch in series with a train of lightning arresters. The nine series of lightning arresters are separated from each other by slabs of slate, each about 30 x 80 inches.

All of the engines before mentioned at the Portsmouth plant exhaust into a central condensing system. The regular steam pressure is 160 pounds. The Holley drip-system is used with all the engines.

A crane with two trolleys of 30-tons capacity each for hand working sweeps the entire engine and generator room. As now installed, the boiler plant is made up of six units, rated at 520-hp each. These boilers are of the horizontal, tubular type, and are provided with superheaters. A mechanical stoker with a capacity of three tons of coal in its bunker per front foot of the boilers, feed their furnaces automatically. All coal is crushed and weighed before passing into the bunkers, and again weighed above each boiler. Coal comes by water, and is unloaded directly into bins that adjoin the station.

An economizer with 10,400 square feet of heating surface receives all the gases from the boilers when desired, being located in a by-pass on the main flue. To ensure ample draft, in spite of the resistance offered by this economizer, two fans with 15-ft. wheels have been provided near the base of the 150-ft. brick chimney, and draw the flue gases through a sheet-iron flue, 15 feet x 7 feet in section. Boiler feed-water from the city mains is forced through primary and auxiliary feed-water heaters of the straight-tube type, and 1,300 square feet of heating surface, and then through the economizer by feed pumps wth compound steam cylinders. Sea water for the central condensing system is obtained through an intake crib from the Piscataqua River.

The generating station on the water front at Portsmouth is a one-story fireproof building with basement, of brick, tile, concrete and steel construction. This building measures 148 ft. 11 in. x 125 ft. 6 in. outside, on corner being cut off along one side, to conform to the street line. Inside, the building is divided by a brick wall into engine and boiler rooms. The engine room is 144 feet 3 inches long, 54 feet wide at one end and 65 feet wide at the other. Inside the boiler room the length is 144 ft. 3 in. x 54 ft. Underneath the engine room is the basement, with its floor level 12.5 feet below that of the engine room floor. Between the floor of the engine room and the bottom cord of the steel roof trusses is 31 feet. In the boiler room the height from floor to bottom cord of roof trusses is 38 feet. The entire building is roofed with hard tile, laid in cement and supported by cross I-beams over the steel trusses. This building is of steel and masonry throughout, wood in its construction is used only at door and window casings, and a space equal to the entire length of this article might easily be devoted to its interesting features. The steel and masonry type of construction has been carried out in the combined substations and car houses of the New Hampshire Traction Company. Of these eight substation buildings, that at Salem, New Hampshire, may serve as a good example, though somewhat larger than the others. This building fronts along the street a distance of 204 ft. 8 in., and etends back from the street 182 ft. 4 in. in the main part. Brick, steel and concrete are the principal materials of construction, and the building is in the main one story, lighted from above with skylights in addition to its windows. The central and larger portion of this building, 118 feet front by 182 feet 4 inches deep, forms the car house, with nine tracks running its entire length. At one rear corner of this car house a space about 55 ft. x 40 ft. is partitioned off for a paint shop. In its central part, the car house measures 20 feet from floor to bottom cord of roof truss, and 18 feet is the corresponding distance on each side. The entire building is roofed with tar and gravel, laid on 2-inch plank that rest in turn on the steel roof trusses. The floor of the car house is 3-inch plank, laid on 8-in. x 10-in. hard pine beams, that are supported in turn by posts of the same material that rise from a sub-floor of concrete, about 4 feet below the plank floor.

A wing at one side of the main building, 48 feet front by 118 feet 4 inches deep serves as a repair shop, winding room and boiler house. Save in the boiler room the wing just named has a plank floor supported by hard pine beams and brick piers. At the other side of the car house is the substation, 38 ft. 8 in. x 81 ft. 8 in. on the ground and 21 feet 4 inches from the concrete floor to the bottom cord of roof truss. This floor rests on steel beams and is 7 feet 6 inches above the concrete floor of the basement underneath. A crane sweeps the substation at a distance of 17 feet above the main floor, and light is received through windows and a central skylight.

Each bare wire of the 13,200-volt transmission line enters the side brick wall of the substation through an opening about 16 inches square. A porcelain insulator is so mounted in this opening that the high-pressure conductor passes through nearly at the center. Outside of the row of openings in the brick wall, and built into it, a stone box is constructed with roof of blue flag-stone, 3 inches thick, and sides and bottom of 1-inch slate. Inside, this box extends 22 inches out from the face of the brick wall, and is 15 inches high at the face. Underneath this box, and with its center eight inches from the face of the brick well, is a large porcelain insulator, on which the high-tension wire is secured. From this insulator the wire passes up through the bottom of the box in a heavy glass tube, and thence to the insulator mounted in the opening of the brick wall. The extreme front of the wing containing the substation is devoted to offices and toilet rooms, covering a ground space of 18 ft. x 38 ft. 8in., and to a locker room for employees in a second story.

The power plant at Portsmouth was designed and built by Sanderson & Porters, New York, as engineers and general contractors. The same firm also acted as consulting engineers for the entire property. Plans for the substations and car houses were made by Sheaff & Jaastad, engineers, of Boston. The electric generators, motors, rotary converters, transformers, switchboards and instruments above described were made by General Electric Company. Boilers at the Portsmouth plant are the product of Aultman-Taylor

Company. The economizer is of the Greene make. Horizontal Corliss engines, used to drive the 1,000-kw, 13,200-volt generators, were manufactured by Providence Engineering Works. All the vertical engines named are of Westinghouse make. The condenser for the engines is of the Worthington elevated pattern. The crane in the main generator room was furnished by the Whiting Foundry and Equipment Company. Roney stokers fire the boiler furnaces.

The new electric cars were built by the Laconia Car Company. Air brakes are of the Standard type. Snow plows are from the Taunton Locomotive Works. Electric motor equipments are mostly of the General Electric and Westinghouse makes.

Underground Work for Telephone Exchanges—VI.

By ARTHUR V. ABBOTT, C. E.

THE more modern type of manhole roof patterns after fireproof building construction, and contains much greater evidence of design. Two or more I-beams or channels of sufficient strength are set across the top of the wall, and brick or tile arches sprung between the beams. Such a roof is shown in Fig. 32. This plan is much more scientific, and is structurally compulsory where vaults larger than 5 feet by 7 feet top are used, but necessitates a correspondingly greater expenditure. In Fig. 33 a special arch brick is shown, manufactured particularly for manhole roofs. It is reported that these bricks are safe for a load of ten tons per square foot, and are designed for 32-inch span between beams. Finally when the necessary time can be allowed for setting, even brick manholes may advantageously be supplied with a moulded concrete top. This method is simple and easy as may be seen be reference to Fig. 29 (Page 496), being merely sheet of concrete about one foot in thickness The only mould required is a staging of plank set inside the vault

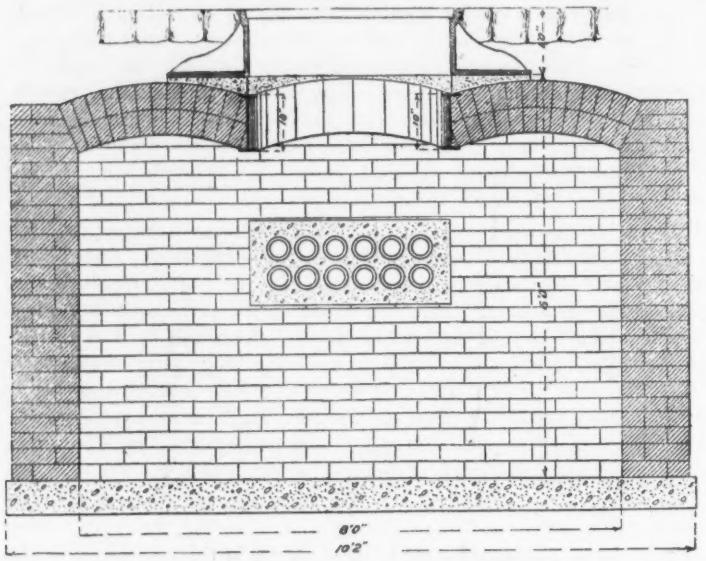


FIG. 32.—MANHOLE WITH ARCHED ROOF.

walls, flush with its top, carrying in the center a section of a cylinder or a square of the same diameter as the hole in the cover. Such a staging can be built in a couple of hours, by even an unskilled carpenter, and the vault completed by dumping concrete thereon and ramming solidly into place. By giving the staging sufficient strength to carry the street traffic, pavement may be immediately replaced, and the staging allowed to remain indefinitely until the concrete has gained any desired strength. Such roofs need no metal reinforcement, and have proved entirely satisfactory in so large a number of instances, even under the most trying circumstances, as to be worthy of the widest application.

The designing of vault covers has presented one of the most vexatious of detail problems, and multitudes of devices have arisen—flourished for a time—and disappeared. Almost every conduit builder has his own pet plan. There are two generic types—the *"Tight"* cover and the *"Open"* cover, while morphologically either may be built on the round or square plan. In early conduits the attempt was made to render ducts water and gas tight, and consequently particular stress was given to making the entrances waterproof. To this end covers, usually round, were made double, as shown in Figs. 34 and 35, having an outer lid flush with the street to carry traffic, and an inner or sealing cover pressed against a packing ring or gasket, designed to make the entrance air tight. In Fig. 34 the packing gasket rests in a circular groove in the underside of the inner cover, which is forced against it by a screw playing through a bar interlocking in the lug *A*. In Fig. 35 the sealing lid is drawn

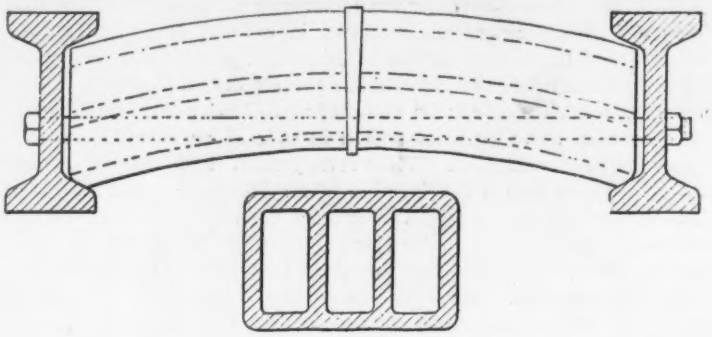


FIG. 33.—SPECIAL MANHOLE, ARCH BRICK.

up against the inside of the cover frame by four bolts. The design of Fig. 34 is the cheaper to build, easier to manipulate and generally most satisfactory, avoiding exposing the cables to the danger of the inner cover falling against their sheaths. In Fig. 34 reasonable drainage of the spaces between the covers is secured by connecting the groove in the frame around the packing ring with the sewer, but in Fig. 35 no such proviso exists, and this space must be cleaned out by hand each time the vault is opened before the inner lid is dropped.

A very short experience with conduit systems demonstrated the futility of trying to make them water tight, and designers reacted

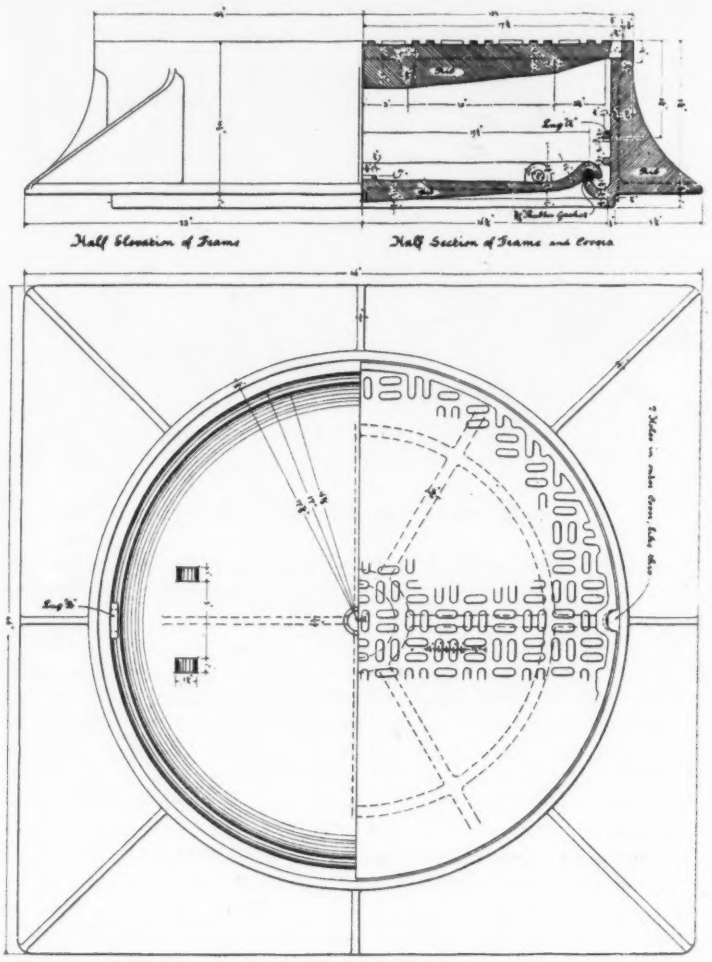


FIG. 34.—CIRCULAR TIGHT MANHOLE COVER, OVERHUNG INNER COVER.

to the other extreme in the endeavor to secure dryness by thorough ventilation. Accordingly, covers were simplified by entirely omitting the inner lid, and in its place hanging a sheet-iron pan in such a manner as to catch any street drainage, as illustrated in Fig. 36; while the traffic cover was pierced with as many holes to permit ventilation, as

strength would permit. The most recent experience indicates that even the pan is superfluous, and present tendencies are in the direction of an exceedingly plain, strong, simplified cover, as shown in Fig. 37.

The prime requisites in the manhole entrance are resistance to

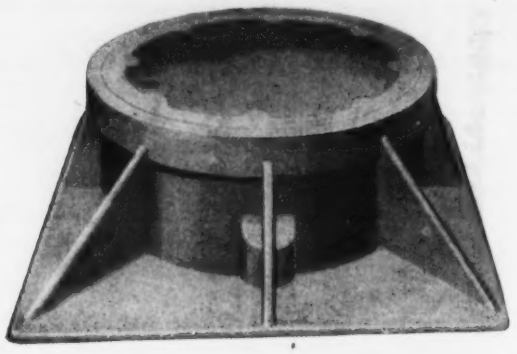


FIG. 35.—CIRCULAR TIGHT MANHOLE COVER, UNDERHUNG INNER COVER.

street traffic and accessibility to the vault. The round cover is smaller, consequently can be built lighter, cheaper and easier to handle, but access to the vault is much more restricted, the difficulty and cost of cable pulling increased, while the light round traffic cover is quite likely to be dislodged by the blows of passing wheels. In the design of Fig. 37 a lock is supplied to secure the cover in place. As a guard against accident, this is valuable, and probably worth both its original investment and its maintenance cost; but as a protection from malicious interference, it is of little moment, as there is no manhole into which a determined party of strikers, easily arming themselves with picks and shovels, could not quickly effect an entrance, while a small stick of dynamite would open the strongest lock in a moment.

Occasionally circumstances compel the construction of a water-tight manhole, then the same engineering precautions must be observed as in building a cofferdam or other subaqueous work. The plan of Fig. 38 exemplifies a successful method. The excavation is completely and carefully sheeted with 3-inch by 6-inch tongue, and grooved matched piling, driven closely together, extending at least 4 feet below the manhole bottom. When the excavation is finished, a double wooden floor of matched tongued and grooved 2-inch plank, the seams in each layer laid diagonally to those in the other, fitted around the sheeting, and calked into place with tar and oakum is introduced. On this floor a course of brick masonry 8 inches thick, laid with Flemish bond, is placed about 3 inches inside the sheeting, the intervening spaces being afterwards tamped full of concrete. The chamber thus formed of the wood floor and the brickwork is

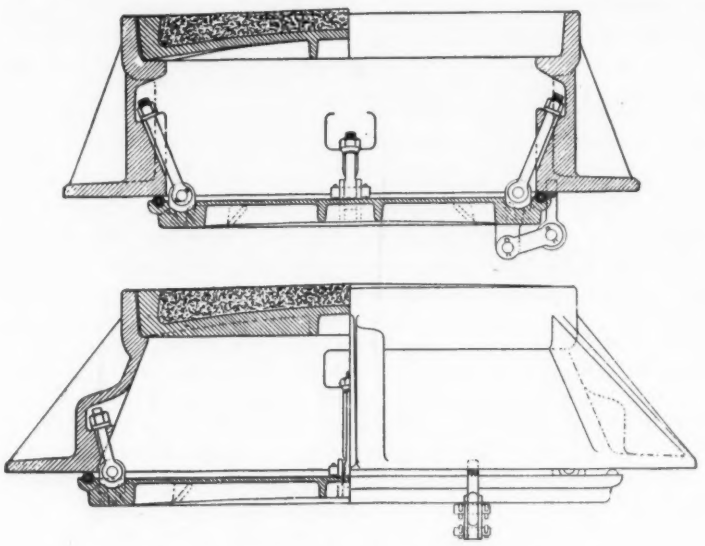


FIG. 35A.—BALTIMORE MANHOLE FRAME AND COVER.

now lined with at least three layers of the best roofing felt thoroughly asphalted and mopped into place. Six inches of concrete are now deposited upon the bottom, then three more layers of roofing felt applied; next 12 inches of concrete to complete the bottom, on which the interior, and vault walls proper, are built. These should be made of brick masonry 12 inches in thickness, laid up in old English bond. All the mason work must be in neat cement mortar, and all joints thoroughly pointed and calked. In such a manhole, the entrance of the ducts presents the chief difficulty, as it is next to impossible to carry in any of the clay forms and preserve water-proofness. By using iron pipe on either side, flanging the same to

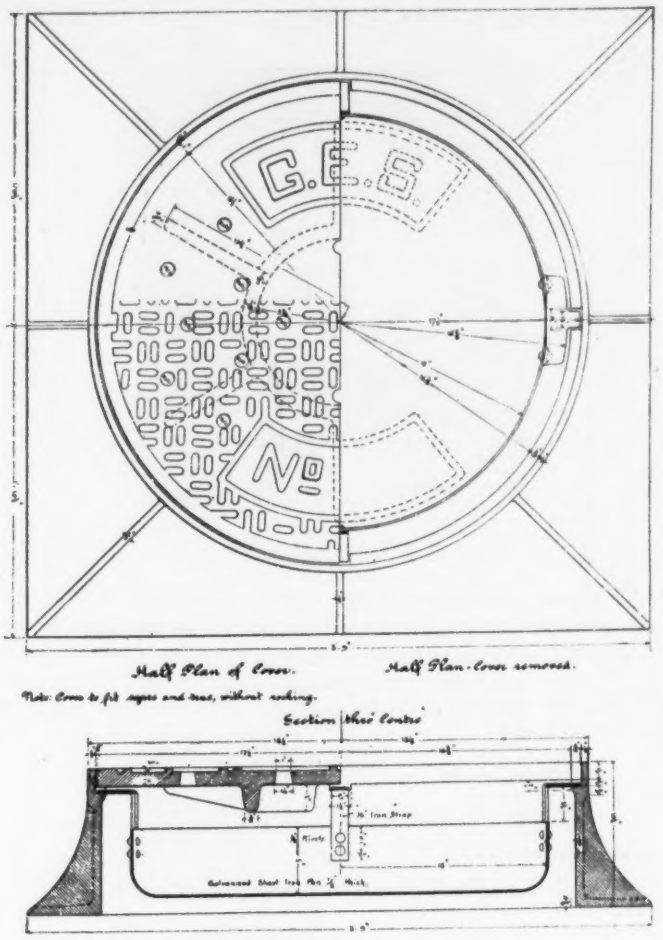


FIG. 36.—OPEN MANHOLE COVER.

the sheeting with roofing felt gaskets, the entrance may be made water-tight.

SMALL MANHOLES.

The design of manholes so far considered has proceeded upon the assumption of providing space beneath the street surface to allow all of the avocations of cable splicing to be performed. In certain localities where conduit systems are not of great magnitude, where street traffic is not excessive, and where great cheapness is desired, a much

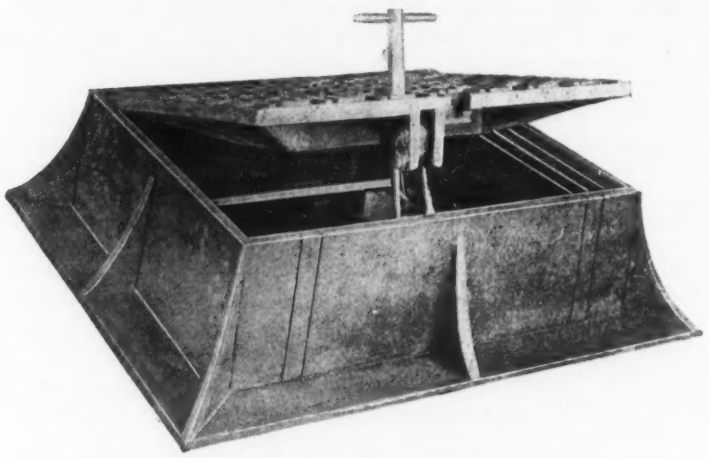


FIG. 37.—SQUARE MANHOLE COVER.

smaller and cheaper style of vault may be adopted. Such manholes are provided with large rectangular covers, about 36 inches by 24 inches. The cover frame is made of angle iron joined at the corners with knee braces, and the cover itself of a rectangular angle iron frame filled with hard oak plank. This provides a cover of great lightness, cheapness, and of reasonable durability under the light

street traffic of cities of 40,000 or less population. The manhole itself may preferably be a brick structure, not over 2 feet in depth, and about 4 feet by 3 feet in plan. Vaults of this description may be constructed either of concrete or brick at pleasure, or even built of 2½-inch matched plank. These manholes are too small to permit of cable splicing inside of them, so cables are drawn into place and spliced in the street by allowing a large U-bend to extend out

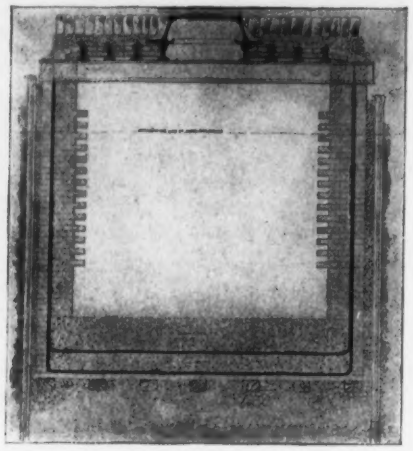


FIG. 38.—WATERPROOF MANHOLE.

of the manhole entrance. After splicing is completed the cables are dropped into place. Such construction is only permissible where a few small-sized cables are used, but becomes desirable in the smaller cities where the underground systems must be constructed with greatest economy, or in the outskirts of larger towns where the systems are rapidly changing.

Recent Electrochemical Developments.

BY CLINTON PAUL TOWNSEND.

CARBORUNDUM ARTICLES.

Mr. Fitzgerald has heretofore described a method of recrystallizing carborundum into definite forms, involving the subjection of the crystals resulting from a previous furnace operation, after molding into suitable shape, to a sufficient temperature to recrystallize the mass.

As is well known, the operation of the carborundum furnaces results in the transformation of the charge, not only into the crystalline carbide of silicon known as carborundum, but in lesser degree into an amorphous carbide, technically known as "white stuff," having a similar chemical composition but quite distinct physical properties. Mr. Frank J. Tone, of Niagara Falls, now patents and assigns to the Carborundum Company, a method which substantially parallels that of Fitzgerald, above referred to, starting, however, with the amorphous instead of the crystalline carbide. As might be expected, the resulting product differs from that of the earlier method chiefly in its lesser apparent specific gravity, or in other words, its greater porosity. This difference is of importance for such uses of the product as subject it to sudden and excessive temperature changes, and fits it especially for use in furnace construction. The degree of porosity may be further increased by mixing with the amorphous carbide of silicon a proportion of the usual charge mixture of sand and carbon, or even by molding the brick or other article entirely from such charge mixture. The articles are conveniently heated by imbedding them in the charge of the usual carborundum furnace, a temporary binder of glue or water glass being added previous to the molding.

OZONIZING APPARATUS.

An ozonizer for which a patent has recently been issued to Alexander Vosmaer, of Haarlem, Netherlands, would seem to represent an approach at least toward the extreme limit of simplicity. The device is without dielectric surfaces or fixed parts, and comprises merely two insulated and self-supporting discharging conductors resting loosely in a conduit, between which and one of the terminals an electric contact may or may not exist. The conduit is conveniently constructed of a section of gas pipe, and the size of the apparatus may be increased to any desired extent by simply assembling a number of sections as in an ordinary surface condenser. The electrodes are given the form rendered familiar by Vosmaer's earlier constructions, in which a series of points constituting the so-called "discharger" oppose a parallel plane surface. As shown in the accompanying cut, a metallic bar, 2, constituting one electrode is fitted with forked insulating standards, 3, 4; a second bar, 5, fitted with the downwardly

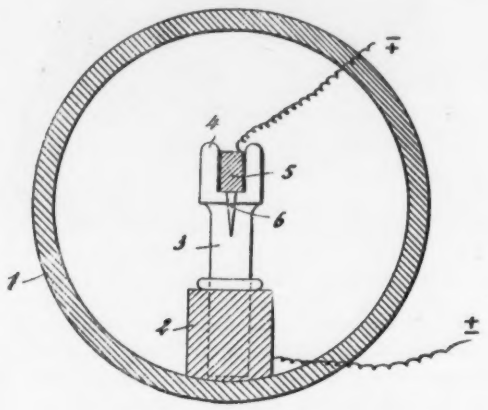


FIG. 1.—VOSMAER OZONIZING APPARATUS.

directed discharging points, 6, rests loosely in the forks of the standards. The two electrodes, so assembled, are placed in the pipe or conduit 1, through which a current of the air or other gas to be treated is caused to flow. An adjustment of distances between the active surfaces is readily effected by an interchange of standards, and either electrode may be replaced with the utmost facility.

SEPARATION OF METALS FROM ORES.

C. E. Dolbear, of Boston, describes, as a method for the direct separation of metals from their ores, the use of a mixed solution of two electrolytes, the one being a solvent for the metal or ore, and the other a suitable electrolyte for the separation of the metal in reguline form. Sulphuric and nitric acids are named, the latter being the solvent. If sulphide ores of copper, for instance, are being treated, the metal is dissolved as a nitrate, converted by the sulphuric acid to a sulphate, and therefrom deposited, the electrolyte reaching a condition of equilibrium beyond which it will suffer only such changes as arise from the foreign components of the ore. There is an especial advantage in conducting the solution as well as the deposition in the electrolytic vat, since the oxides of nitrogen resulting from the reduction of the nitric acid by the metal are continuously reoxidized to nitric acid by oxygen liberated at the insoluble anode. The patent is the property by assignment of the American and Metal Extraction Company, of Boston.

ELECTRODEPOSITION OF COPPER WITH INSOLUBLE ANODES.

An ingenious electrometallurgical method for the treatment of sulphide ores of copper is proposed by M. Constantin Jean Tossizza, of Paris. The copper in such ores is associated with iron and the sulphate solutions obtained by treating the roasted ores with sulphuric acid are unsatisfactory electrolytes: for although copper is more readily deposited than iron, no separation of the metals is practicable with insoluble anodes. Such separation would involve the maintenance of the e. m. f. between terminals at a necessary minimum, whereas the polarization of the anode quickly raises it to a point at which iron also separates. M. Tossizza introduces into the bath in the neighborhood of the anodes, the sulphur dioxide derived from the roasting, thereby reducing the potential difference to the theoretical figure of 0.2 volts, or under practical conditions to 0.6 volts. Obviously the e. m. f. necessary for the separation of iron is reduced in similar proportion, but with effective depolarization such intermediate values may be maintained as will permit the separation of the copper alone.

The relation of this process to the prior art is somewhat peculiar. The method, that is to say, the use of reducing gases, and particularly sulphur dioxide for the depolarization of insoluble anodes in the deposition of copper was described in 1878 by Cobley. The realization that thereby the purity of the separated metal might be

controlled is due to Tossizza, who is, therefore, to be considered as the inventor of the method as applied to ferruginous solutions. On the practical side the process confronts the fact that no thoroughly satisfactory anode material for sulphate solutions is known.

MERCURY CATHODE CELL.

In an electrolytic cell for the production of caustic soda by the deposition of sodium in mercury and its oxidation therefrom by water, the quantity of mercury, and therefore the cost of the cell, is largely controlled by the efficiency of the means employed for promoting the oxidation of the alkali metal. The most efficient, as well as the most economical of all means for accomplishing this end is the employment of a "combining circuit"—such arrangement of terminals that the mercury functions, in part at least, as a bipolar electrode between independent anodes and cathodes located respectively in the decomposing and oxidizing compartments: this principle of operation is known as the Castner-Kellner method.

Many efforts have been made, however, to effect the quick oxidation of mercury by means of local action. The use of metallic fragments floating upon the mercury is less effective than would be supposed, by reason of their tendency to become amalgamated, or at least coated, with the liquid metal; and floating fragments of carbon do not seem to come into effective contact with the amalgam. Messrs. Edser & Wildermann, of London, propose to use carbon and metal together, in the form of composite rods projecting from the base of the caustic compartment through the amalgam and into the superposed caustic solution. These composite rods are preferably of iron and carbon, and may be prepared by producing a partial electrodeposit of iron on carbon pencils, by wrapping carbon pencils with iron wire, or by molding them from a mixture of carbon with iron filings. They may be given the form of rods or plates, and may be applied to rocking or rotating cells of any known type.

As above stated, the function of these elements is to promote local action, and it follows that however effective they may be in promoting oxidation of the alkali metal, their use represents a considerable waste of energy as compared with the employment of a combining circuit in which the electrical energy derived from the oxidation of the sodium is turned into the electrolyzing circuit..

THE FIXATION OF ATMOSPHERIC NITROGEN.

A recent issue of the ELECTRICAL WORLD AND ENGINEER described the Niagara Falls installation of the Atmospheric Products Company for the synthetic production of oxides of nitrogen. In the construction there described the arcs are produced in a high-tension, direct-current circuit, and are most ingeniously maintained, by relatively moving terminals at that minimum amperage which corresponds with the maximum permanent synthetic effect. As stated in the paper referred to, an experimental study has resulted in favor of the direct-current arc. The current patent issue includes, however, a construction assigned to the same company, the patentees being Messrs. Bradley and Lovejoy, in which an alternating arc is applied to the same purpose. While this must be considered, upon the statements of the patentees, as a less efficient form of the device, it is nevertheless of interest as showing a means, devoid of moving parts, for maintaining the arcs at the minimum volume. This is accomplished by permitting the arc to strike across the narrow gap between two divergent terminals, and causing it to travel upward under the influence of the air current until it finally breaks at the point of widest separation of the electrodes. The current used being alternating, individual transformers replace the inductances used with the direct current.

As here figured, the individual combining chambers 1 carry diverging metallic terminals, 5, 6, connected to the secondary, 9, of the coil 9, 10. The air enters at 2, directly beneath the point 7 of closest approach of the terminals, and the product passes through conduits 3, 4, to the absorption tower 14. The coil is imbedded in insulating cement, 26, and the primary and secondary terminals, 30, 27, are so arranged that the act of placing the coil in position closes the circuit on the one hand with the line wires, 32, of the alternating circuit, 11, 12, and on the other with the terminals, 28, of the electrodes. For absorption of the oxides of nitrogen sulphuric acid is employed, and is caused to circulate over an insoluble distributing filling, 15, in the absorption tower, and thence through a cooling chamber, 23, by means of the pump 21. The residual air is withdrawn by the pump 24, while the absorbed oxides of nitrogen are expelled from the acid by heat applied to the vessel 16, to be condensed in the worm 18 and collected in the vessel 20. The use of an acid absorbent offers great economy over the employment of an alkali, since the absorping liquor is not subjected to chemical change. As will be clear from the drawings, the successive arcs struck at the point 7 will, under the influence of the upward air current, rise along the electrodes and break at their point of widest separation.

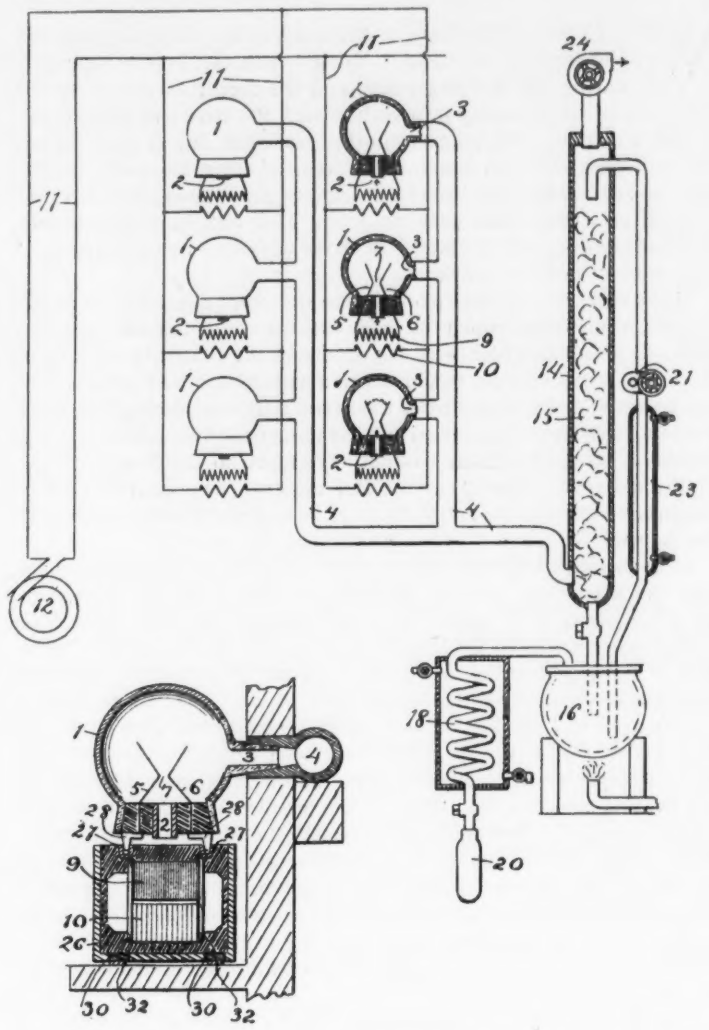


FIG. 2.—FIXATION OF ATMOSPHERIC NITROGEN.

The Point of View.

That it all depends on the point of view is again illustrated by the following paragraph from the New York *Evening Post* of recent date: New Orleans has been enjoying a street-car strike for the last ten days or so. Other cities are inclined to complain and lament when their transit facilities are interfered with by labor disputes, but not so New Orleans. "What a relief it is," cries one enthusiastic newspaper, "that this dear old town of ours should have been suddenly blessed with a Sunday that must have brought back to the older inhabitants the peace of quiet and the Sabbath-keeping of 50 years ago." And further on this same paper says: "When the day was done—and the last note from the church bells had become solvent in the silence of the city, how comforting it was to step to your window and to look out upon and over the wide stretch of houses and to know that in each one of them prayers of thanksgiving were being said for the gracious day-long quiet that had blessed the whole community! How you longed then for the days when the telegraph and the telephone and the trolley were unknown, when even the car rumbled not over the stony street; when men and women made use of the vehicles of locomotion God had given them; when, in a word, man, as well as all other creatures of the Creator, was satisfied to be natural." This, by the way, described the first Sunday of the strike. It would be interesting to know whether a sentiment so sublime has survived the exclusive use since then of the God-given "vehicles of locomotion."

The Installation of Electrical Machinery in the Tropics.

By Chas. H. Hines.

With the rapid increase of the work of installing lighting and power plants in countries lying within the tropics, especially during the last five years, and the recent extension by the United States of its sway into such climes, the writer of this article, having been one of the pioneers in this particular line at a time when the field was new and untried, and remembering his own troubles and the lack of any previous knowledge to draw upon, feels that the relation of a few of the peculiar "bugs" that may be expected, may prove interesting and profitable to those who may be called upon to undertake this class of work.

In the early days of this work, it was the usual thing for the South American merchant when he had decided to install an electrical plant, to place the order with his agents in the States in very much the same manner as he would order a consignment of groceries or other goods; and in many cases the agent, only considering how large a commission could be exacted and the cheapness with which he could purchase, bought the plant without any regard to the class or fitness of the material. Finally, at the last moment, he would engage an engineer to go with the outfit, to erect it, and usually his selection of the man was on a par with his selection of the material.

In most cases the engineer arrived at his destination only to find that the machinery ordered was either not adapted to the requirements of the case or wofully lacking in many essential things. This meant many weeks of delay and vexation, and this coupled with his lack of knowledge of the country and customs, rendered his employers only too prone to place the blame upon his shoulders, forgetting the fact that he had not been consulted in the least regarding what had been ordered, and that he would have been entirely unfamiliar with the peculiar necessities involved, even had he been so consulted. At the present day, however, the field has broadened, and in the case of many large power and lighting enterprises the services of skilled consulting engineers are called upon to direct the preliminary work; but it will be found in most of these cases that these enterprises are backed or controlled by American capital, and that the native of the country when left to his own devices still persists in putting the cart before the horse—that is, buying his plant first, and hiring his engineer afterward.

The first and most important thing to be considered in taking up this class of work is a thorough knowledge of the foreign language; for without that the engineer, no matter how great his ability, will find himself sadly handicapped. Even though he may procure the services of an interpreter, he will soon find that he cannot depend upon him to interpret faithfully, and will be led into serious errors owing to mal-interpretation, both as to his work and to differences with his employers. In many cases this occurs through maliciousness due to jealousy or other causes, and is always a constant source of annoyance. I well remember my own first experience, when my knowledge of Spanish was nil, and I used to wander around with a piece of paper on which I had written down the Spanish and English meaning of different tools, etc., forgetting that the pronunciation of the words was most essential. On getting screw-drivers for screws, wrenches for bolts and like mistakes, I would be gravely assured by the dusky workers in my employ that my Spanish was "muy malo"—very bad—and I have no reason to doubt them, judging from the results obtained. Spanish is an easy language to acquire, and should be learned in advance, as the process of learning on the ground is slow, vexatious and costly.

Before sailing, the engineer should always go carefully over the list of materials sent, checking off all articles, and being sure that he has everything required to the very nails and screws, for should anything be omitted it may mean weeks of delay, and in any case he will pay dearly for what he has to purchase on the ground, even if obtainable. I well remember on one installation which was to have iron poles made of three sizes of pipe connected together by reducers, and, through error, sufficient reducers were sent for but half the number of poles, being fortunate enough to be able to find them in the town I was under the necessity of paying $4.50 apiece for an article worth about 30 cents in the States.

Arriving at his destination, the engineer will find that his machinery is generally handled in any old way. He must personally supervise the unloading of the same if he wishes to preserve it unbroken, and his ingenuity will be called upon from the start if the plant is located at any distance from the port of disembarkation; as in most instances mules or oxen are the sole means of transportation, and the roads are invariably vile, even in the dry season, and generally impassable during the wet one. I have been three months conveying the heavy castings of generators over a distance of 40 miles. A knowledge of the conditions to be met with in advance is here of great service in regulating the weights of the packages to be handled. It is here also that the first lesson regarding himself must be learned by the engineer, and that is the care of his health. If the place where he is located is unhealthy, and most tropical towns are more or less so, too much care cannot be taken until well acclimated. He should wear a flannel band around the stomach, drink sparingly of water, and that filtered or boiled, avoid much fruit, and always sleep a story or two above the ground, the higher the better, and also keep indoors at night; and above all things, observe the strictest temperance. Right here, let me explode a fallacy that has caused the death of more than one bright man in these countries, and that is the saying that will be repeated by natives and even his own countrymen located there, that "a little liquor is absolutely required in the drinking water," or "drink to keep out the fever germs." This is not only untrue, but the surest way to bring about what he wishes to avoid. I have tried both methods; in one case succumbing to fever within two weeks, and in the other I passed six months in one of the deadliest ports of South America untouched by any disease by practicing strict abstinence.

We will now suppose the engineer on the ground where the plant is to be erected, and ready to begin operations. Now begins the test of his fitness for this class of work, as he finds that he must be in turn surveyor, mason, blacksmith, machinist, boilermaker, engineman, lineman and a few other things, besides being an electrical engineer. The first and greatest trouble to be encountered is labor, and this varies greatly in different countries. I have found the brightest and best men in Central and South America, many of them capable of being taught anything, and generally willing and sober; while the poorest class of labor I have met with has been in Cuba and the West Indies. But wherever found, save in the large cities, they are in most cases ignorant of even the appearance of electrical machinery, and must be taught from the beginning even how to handle tools; and tact and patience of the highest order is required. The motto of the Latin-American workman is, "never do anything to-day that can be possibly put off until to-morrow," and the employer must go slowly in combating this idea lest he incur the hatred of his men—this meaning in some cases his sudden decease. He will learn the word "manana" (to-morrow) until he hates the sound of it, as, no matter what he wants done or how urgent it may be, it will be done "manana." However, patience, and above all a perfect command of temper, will overcome all obstacles in time, and he will find his troubles lessening as his pupils grow more apt. Let him always direct and not try to do it all himself. The saying is in these countries, "If you see one man working and the rest sitting down, the man working is boss; and if you see one man sitting down and the rest working, the man sitting down is boss;" and it is most true in every respect.

In handling and erecting the heavy pieces, the engineer had better personally see every hitch and tie made on all work, as otherwise disaster is sure to follow. This also applies to line construction, until his men become more or less familiar with the work; they will generally spurn "climbers" and work with bare feet and a rope around the waist, but will get there just the same. The matter of insulation must be carefully looked after, owing to the heavy rains and dampness of these climates. All work in this line should be done in the best possible manner, as on this will depend to a great extent the success or failure of the plant, and the higher the voltage carried, the greater the safeguards to be taken. In the matter of poles, galvanized iron is the most reliable, as insects and dampness soon play havoc with the best of wood, and the expense and labor attached to replacing them more than balances the extra cost of the iron ones.

In the matter of stringing wires, the fact of the great expansion during the intense heat of the day and contraction in the almost always cool nights, must be taken into consideration, or trouble will ensue from the start; and above all, the matter of protection from the heavy thunder showers of the tropics must be given the most careful study. The very best arrester obtainable should be employed, and all parts of apparatus liable to injury carried in duplicate, especially armatures, unless the engineer is capable of rewinding the same. Right here let me say that nine-tenths of good engineers are unfamiliar with the practical part of armature and field winding, no

matter how well they may be grounded in the theory and design, yet such knowledge is invaluable in this class of work.

If the prime movers of the plant are wheels or turbines, as in all cases where possible they should be, owing to the high cost of fuel—coal costing in many parts as high as $20 per ton, gold—another factor of trouble must be considered in planning the hydraulic part of the station, and that is the rapid rise that takes place in the streams after a heavy rainfall. I have seen a river from which I derived my power rise 15 feet in as many minutes. Great care must be taken to provide for this, more especially if the work is installed during the dry season, as otherwise the labor of months may be destroyed in a brief hour. In all cases these streams are filled with floating vegetation and drift, causing endless trouble in clogging turbines, breaking gate valves, etc., if not most carefully provided for.

We will now suppose the station completed and everything ready for the start. Let it not be thought that the troubles of the engineer are over; for, on the contrary, they have but begun. He will now appoint his assistants from among the best of the men who have aided him in the construction, and it is now he will encounter fresh troubles. The egotism of the average native is prodigious, and he will at once, on attaining a little knowledge, assume much more, and, if not closely watched, will cause disaster by attempting to do more than he is capable of doing. He will handle the most intricate machinery with a superb disregard of consequences that will make the beholder shudder, and is only too ready to do, not what he is told, but also what he is told not to do. When he has worked a few months, he considers himself a full-fledged "electricista," and resents any further instruction. I well remember an instance which illustrates this fact, in a plant which I had erected, and in which on occasions we were obliged to run our alternators in synchronism. I had a rather bright native acting as station man, and I cautioned him particularly never to attempt to throw his machines together without first calling me, as, owing to several causes, the synchronizing of the machines was a difficult matter. My back was hardly turned, however, when he *did* throw them in without synchronizing, with the result of his leaving by the window route, leaving me with a two weeks' shut-down on my hands. In this connection there is a story which I can well believe of a Mexican who was left in charge of the boiler of his plant, and the superintendent happening in later saw to his horror that the handle of the steam gauge was crowded over against the pin at the far side, while the engineer was still feeding the roaring furnace for all he was worth. As soon as the superintendent could haul the fire and get his breath, he inquired the reason of such proceedings, and the answer was, "Well, what are the figures there for if the steam is not to go to that point?"

There is another side to this matter that has a more or less serious bearing to the seller and manufacturer of the plant, and that is that when the contract of the engineer who erects the plant expires, in nine cases out of ten his employers will either refuse to renew the same or insist on his accepting far less salary. In most instances they have a touch of the same egotism, and think that one of their own countrymen is entirely capable of taking charge at far less money, and the consequence of this idea is, in many cases, the total ruin of the plant, with the fault laid at the door of the makers of the machinery, when it is the fault of the unskilled man who was placed in charge. I have seen in a Mexican city, a fine new plant, with the most approved apparatus, engines, etc., and after a year's run under native management, I have seen the same plant again, its fine machinery rusted and covered with filth and oil, the belting saturated with resin and the whole place a wreck, while the line work had fallen into a condition that not only endangered the plant but the lives of the citizens.

After starting up and getting the plant to running in more or less smooth shape, other troubles may arise, caused by the ignorance or the superstitions of the natives. Lamps are stoned and broken, lines cut or poles uprooted, and for these troubles drastic remedies are needed. The severe punishment of any offender caught will generally have a salutary effect on others. This annoyance is not always confined to the ignorant, however, as in the case of one plant which I erected and where from the start I was bothered by the continual breakage of lamps. I found on doing a little quiet detective work that the chief offender was no other than the cashier of the bank there, who found it "great fun" on his nocturnal rambles to destroy property. A fine of $200, coupled with the threat of a long term of imprisonment for a repetition of the offense, convinced him that this class of fun was an expensive luxury.

In conclusion, I may say that these countries have but just awakened to the necessity of electrical development, and in the near future will be the chief fields of electrical enterprise as they become more developed and opened up by the energetic Anglo-Saxon. At the present time any young engineer who understands his profession and their language, and can interest capital, can find valuable franchises in these countries for almost the asking. The chief trouble that arises to-day is that the salesmen and engineers from America have not made a study of the manners and customs that prevail in these parts, insisting rather that the people should conform to *their* customs. It is through this that the English and the Germans to a large extent control this field. The Latin-American does his business in his own peculiar way, and while it is not our way, yet it will prove vastly more profitable to study this way and meet it, than try to force him to ours. Long credits and a leisurely method in following out an idea is his motto, and our German and English cousins by conforming to his ideas have succeeded, while our men with their "push" and determination to "rush" things have failed through the very thing that has brought them success in other parts. Let them cultivate patience and make a study of the people and their customs and manners, and be willing to devote a month where they are accustomed to spend a week in arranging a sale or a contract; and in the matter of credits and terms, meet the foreign manufacturer on his own ground, and then backed by the superiority of American machinery their reward will be rich and the foothold obtained lasting.

The British Pacific Cable.

A telegram from Vancouver, B. C., of September 21, says: The cableship "Colonia" has laid over 500 miles of the Pacific cable between Vancouver Island, B. C., and Fanning Island. In two weeks the "Colonia" will have paid out all her cable and be within 200 miles of Fanning Island, where she will anchor the end to a buoy. The end will be picked up and spliced by the cableship "Anglia," and the laying completed by that ship, while the "Colonia" will proceed to England to secure the cable for the line between San Francisco and Manila. The "Colonia" is laying 160 miles of cable a day, is traveling at a speed of seven and a half knots, and is in constant communication with the Banfield Creek station on Vancouver Island.

Rapid Transit at the St. Louis Fair.

It will cost $750,000 to construct and equip the rapid transit system upon the World's Fair grounds. The length of the road and its branches will be eight miles, and it will enable the visitors to see the vast exposition with as little fatigue as possible. The problem in planning the intramural road has been to place it where it would not mar the beauty of the exposition. Eminent engineers have been called into consultation and all phases of the project thoroughly studied. It is believed the plan presented by Charles V. Weston, of Chicago, comes nearest to a perfect solution of the difficulty. Owing to the varying altitudes of the exposition grounds the road will be at times an elevated line, and in other parts built at grade or below the surface. The trip on the intramural will be one of the most delightful diversions for visitors to the exposition.

Another Water Power Project in Canada.

The development of the High Falls on the Lievere River, Quebec, about 30 miles from the city of Ottawa, is being projected. There is a drop of 180 feet at the falls, and further drops between the falls and the outlet in the Ottawa River. In all, at lowest water, the Lievere River from its falls to its mouth, can probably produce 50,000 hp of electrical energy, which can be transmitted to Ottawa and other points. Electrical energy, produced by water power, costs in the Ottawa Valley, at present, about $15 per hp per year, while the same amount of power produced by steam costs upwards of $50 per annum, but with the important difference in favor of water that the steam produced power is only for the ordinary working day, while the water produced power is for the whole 24 hours. The Ottawa Valley is a veritable store-house of power. The Rideau, Lievere and Gatineau Rivers; the Chats Falls, Dechenes Rapids and the Chaudiere Falls are destined to make Ottawa the center of a vast supply of electric energy when all these water powers are fully developed.

New Telephone Patents.

In some localities telephone service has not been considered by the public all it should be, all trouble being promptly charged to the operator. This has led many inventors to try to perfect some system in which the much-maligned "central" would be superseded by machinery under the immediate control of the calling subscriber. Lately several such systems have been the subject of letters patent, and the Patent Office issue of September 23 adds two more to the list. One patent (No. 709,739) is issued to Albert W. Bullard, of Somerville, Massachusetts, and the other (No. 709,740) to the same inventor, in conjunction with Malcolm C. Rorty, both patents being assigned to the American Bell Telephone Company.

Each patent covers a separate and practically complete system, both of them being that type of automatic exchange which requires for each subscriber a machine operated electrically and controlled from the subscriber's station, involving a complete multiple of all other lines. As usual with systems of this type, a dial and pointer is provided at each telephone instrument, the pointer being movable over the dial. In addition, the machine at the central office contains an equivalent of this in one or more arms which carry contacts movable over a dial whose divisions are conducting bars, the divisions and numbers on the substation dial corresponding exactly in angular arrangement to the conducting bars and the numbers of their connected subscribers' lines. The method of operation provides that if the pointer is set opposite a given number and the electrical circuit of one or both sides of the line, as the case may be, is then closed, the pointer will return to the normal or zero point, the arms at the central office being synchronously moved forward an exactly equivalent distance so that they will register with the conducting bars of the line whose number on the dial was chosen. In addition to this, means are provided for determining whether the line whose connections is desired is busy, in which case the connection will not be established but a humming signal will be received at the calling station to indicate this fact. When a call is completed, as signified by the return of the receiver to the hook, all conditions are restored to normal by springs properly arranged. As above indicated, the general functions performed by the machines of the two systems are identical, the means by which they are performed, however, differ quite materially.

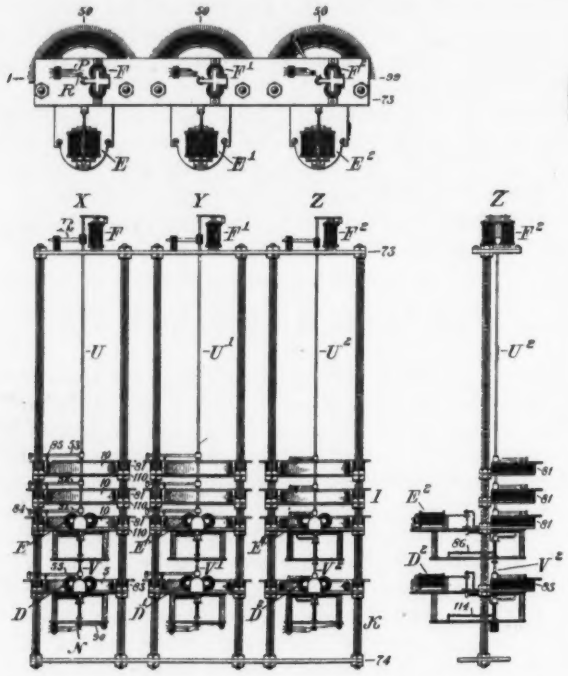


FIG. 1.—CENTRAL OFFICE APPARATUS, BULLARD AUTOMATIC TELEPHONE SYSTEM.

Considering first the system of which Mr. Bullard alone is inventor, Fig. 1 shows a plan and two elevations of three central office machines. In the plan view the conductor dials are shown, giving the appearance of combs, which term will be hereinafter applied to them. Four of these combs with the allied revolving arms are shown in each machine, this being due to the fact that provision is made for a large number of subscribers; and in order to keep the parts of practical size, it is though advisable to divide the subscribers' lines into groups of 99, and arrange one group upon a comb. It may be well to mention here that there are but 99 lines per group, because, the inventor states, it is advisable to omit numbers which would involve a zero setting on the dial, on account of the likelihood of one forgetting to make such a setting. In arranging the combs, all conductors of the same number are in the same vertical plane. Similarly, the contact arms are aligned vertically, so that if the upper arm is in contact with the fifth bar of its comb, the fifth bar of every other hundred group will be in contact with its corresponding revolving arm. This contingency is provided for by the use of a hundreds-comb, the lowest in the figure. In addition to the radial bars, every comb is provided with a circular conductor, so placed that the electrical connections are always carried through it, these latter conductors being wired to and controlled by bars of the hundreds conducting comb, placed with exact reference to the hundreds number of their attached combs. This is one of the chief novelties of the invention, and may be more clearly traced out from the circuit shown in Fig. 2, where the combs and arms are shown for convenience, in plan one above the other instead of superimposed.

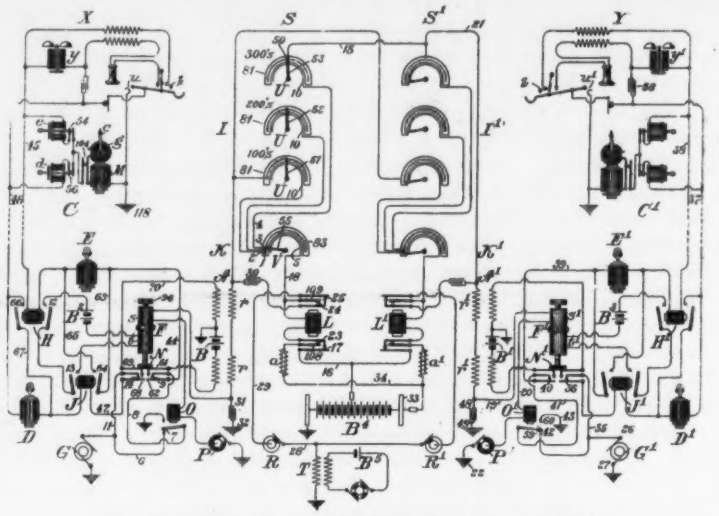


FIG. 2.—DIAGRAM OF CIRCUITS, BULLARD SYSTEM.

The subscriber's station dial, together with the internal mechanisms, are well shown in Fig. 3, the apparatus being given in diagrammatic form in the circuit drawing, Fig. 2. It will be noticed, a single dial is provided, the numbers on which are from 1 to 99; but two push buttons *d* and *e* are shown below the dial, and it is these buttons, which, after the dials have been set, start its motion and determine whether the "hundreds" or "tens and units" mechanism at the central office shall follow the movements of the pointer.

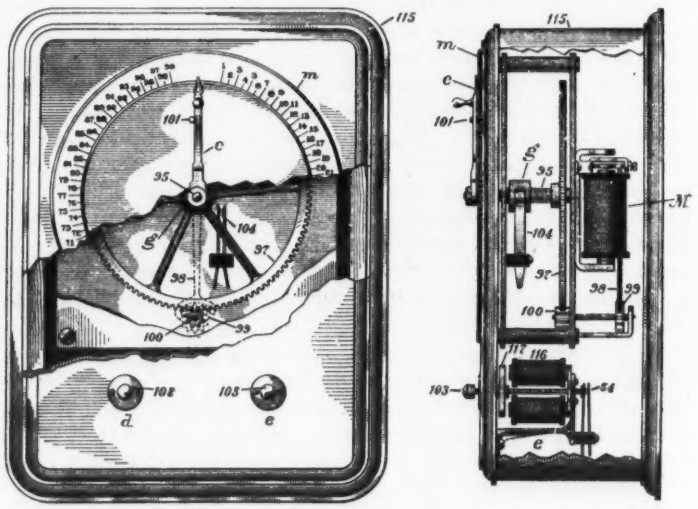


FIG. 3.—SUBSCRIBER'S SELECTION MECHANISM.

Looking at the circuit, party *X* desires line *Y*, whose number is shown as 350. *X* first divides this number into two parts, 3-50, and sets his pointer at 3, then pushing button *d*. It is seen that button *d* closes a contact in series with the coils of its own magnetic clutch and also in series with a contact 104, which is closed except when the

dial pointer is exactly in its stopped or normal position. Thus when *X* depresses *d*, a current passes from the alternating-current generator *G*, through contacts *N*, relay *S*, magnet *D*, line wire 46; through key *d*, contact 104 and magnet *M* to ground. This locks *d*. It also operates relay *J*, which, however, is not at this time significant. In addition to this it energizes magnets *D* and *M*, which are polarized and whose armatures are arranged exactly similar to a polarized bell.

The effect of the alternating current is, therefore, to vibrate in synchronism the armatures of *D* and *M*, which armatures are geared through the agency of escapements, respectively, to the arm of the hundreds comb and to the dial pointer, with the result that the pointer is returned to the stop position, when the circuit is opened, while the arm is advanced to its third conducting bar. The arms of the units and tens combs do not at this time move, as the shaft is divided between the hundreds and next higher comb, and the independent rotating magnet *E* is provided for its upper portion. *X* next proceeds to send in the number 50 through the agency of button *e*, which controls apparatus on the side of the line marked 45; and by means of polarized magnet *E* the units and tens arms are brought above the conducting bars, 50

Up to this time no actual contacts at the combs have been made, for the rotating arms clear the conducting bars until depressed by the next operation, which is the removal of the telephone from the hook switch at station *X*. As the hook switch ascends, it makes a transient contact at *u* to ground just after closing contact *z*, with a result that current from *G* passes out both sides of the line, at the same instant operating relays *J* and *H* simultaneously. This not only operates the magnet *F*, and its associated switch *N*, but depresses the revolving arms so that their contacts engage the conducting bars and circular contact strips. Relays *H* and *J* also short-circuit the polarized magnets *D* and *E*, but even then there is likelihood that the armatures of these latter have made one or two vibrations moving the arms out of register with the comb bars. This, however, is rendered of no effect, as the escapements are so geared to the pointer and contact arm shafts that a considerable number of vibrations of the armatures is necessary for appreciable displacement of them; and as a further precaution, the contact springs of the arms are flared at the tips, so as to be in a measure self-centering.

Now is the time for the machine to discriminate between a busy and free line, and this is accomplished by relay *L*, which is wired through its contacts to the middle of the battery *B* (*B*, *B1*, *B2*, etc., all being one and the same battery), and to the hundreds comb, which has just been connected to bar 350 or *Y's* line. If *Y* is busy, he may have called some one or may have been called. In either case, the relay *L* will be between equi-potential points, and will fail to operate, but will send out to *X* from its back contacts a hum, repeated from the interrupter near *B5*. In case *Y* is not busy, relay *L* operates through a circuit involving *Y's* repeating coil, *N1* and relay *O1* thereby removing one side of *Y's* line from generator *G*, and so grounding it that the bell at station *Y* will be rung by the currents from generator *G*. *Y's* answering operates exactly as for *X*, the magnet *F1* stops the ringing and completes the connection.

To the system of Messrs. Rorty and Bullard, in conjunction, much of the foregoing description of apparatus applies, except that but one comb is used for all subscribers, the total number contemplated in one exchange being small. In this case the motor mechanism of the machine operates by direct battery in synchronism with a make-and-break device, operated by the dial pointer. This system is adapted for use wtih party lines rung on the code system, and thus the electrical circuit from end to end of a completed connection must be continuous without the intervention of repeating coils. Furthermore, as with party lines it is essential to have a subscriber listen to ascertain that the line is free before starting a call, all circuits are arranged so that the removal of the receiver from the hook is the first requisite of calling. The action of selection hinges upon the action of the peculiar relay *R*, which is shown diagrammatically in Fig. 4. This relay has two armatures controlling independent contacts, and two windings, the whole so arranged that while the armature *h*, will operate quickly, and, therefore, follow the impulses of the circuit breaker at the station, the armature *g* will only respond after the current is steady, the dial pointer having come to rest.

In this system, as in the foregoing, the busy signal is a hum or buzz in the receiver, the busy test and non-interference features being controlled by the differential relay with windings *s* and *r*. Normally, the comb-conducting bars, *v*, *v*, are free from battery, but when a connection is established these are so involved as to be supplied with current from the battery. Thus from the circuit (Fig. 4), in case the line *Y* is free, but one coil, *s*, receives current, and the relay operates; but if *Y* is busy both relay coils receive current and the relay fails, the busy tone being supplied to *X* through the back contacts.

Among the most novel features is the ability to call from one station on a line to a second and be secure from interruption from an outside call for the line which is well provided for. The existence of parties on one's own line having the same code ring as the desired party on another line has been taken care of by the combined effects of grounded ringing current thrown on either side of the

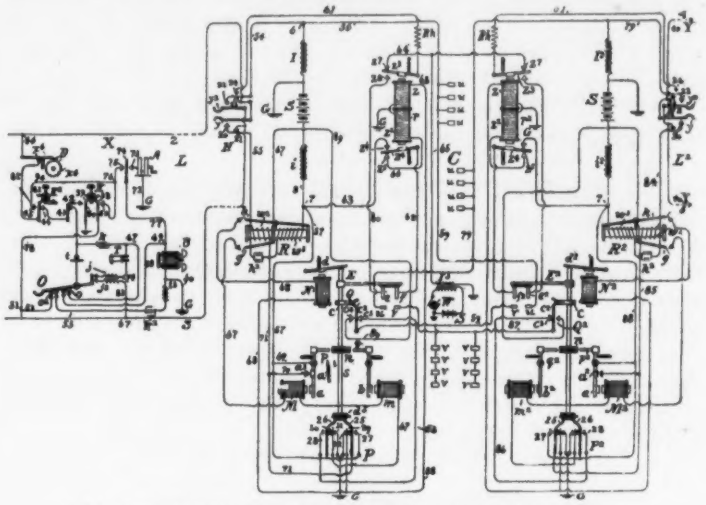


FIG. 4.—DIAGRAM OF CONNECTIONS, BULLARD AND RORTY AUTOMATIC TELEPHONE SYSTEM.

line by suitable keys, and the complete reversal of the line at the central office before connection is completed.

From the detail patent drawings it would seem that the machines and station apparatus are well worked out for both these inventions, so that wiring and adjustments can be made easily accessible, the latter and, in fact, the whole machine being of fairly simple construction. Moreover, the keys, relays and magnets have the appearance of conforming closely to standard telephone practice, a quality often wanting in inventions of this kind. From the standpoint of maintenance, both systems also appeal to one in eliminating the continual wear of the contacts of the lower numbers, which is a property of so many previous systems of this type.

Electrical Method of Framing Glass.

We recently printed an account of a patent granted to H. W. Scattergood on a process for an electro deposited framing for stained glass windows as a substitute for the usual lead frame. In a patent granted September 30 to the same inventor, further details connected with the application of the process are given. The design of the object is first produced on thin paper, on which are then stuck the pieces of glass by means of a suitable adhesive, spaces being left between the various pieces of glass and between the design as a whole and strips of wax or other non-conducting material laid around the same. A curve of considerably greater height than that of the highest piece in the design is then placed around the whole, and the various spaces filled with some substance, such as starch in the form of paste, which is capable of being dissolved or washed out of the spaces. The object is then covered with sand to the top of the curb, a board placed thereon and clamped to the lower board upon which the design is laid. The whole is then reversed, the former bottom board removed, the paper stripped or washed off, and the substance in the spaces metallized by the application of a suitable metallic powder, which is then painted over with fluid wax, which in turn is backed with molten wax. This forms the backing during the remainder of the operation. The curbs and supporting boards are then removed together with the sand and temporary filling in the spaces, and the whole object exposed to the action of an electrolytic bath. The electro deposition proceeds until a frame is formed of sufficient thickness and rigidity to support the constituent pieces of the object when removed from the backing. It is claimed that the pouring of the wax on the constituent pieces makes a perfect contact with these pieces and prevents the spreading of the deposition under these pieces and leaves only the spaces to receive the deposition.

CURRENT NEWS AND NOTES.

CHICAGO ELECTRICAL ASSOCIATION.—Mr. Edward W. Jewell, president of the Jewell Electrical Instrument Company, gave an illustrated lecture on "the History of Electrical Measuring Instruments and Some Novel Uses of Them," on the evening of October 3. His discourse was devoted mainly to the Duprez-D'Arsonval type of direct-current instrument now used in commercial portable work.

STREET SIGNS.—A patent granted September 16 to J. W. Lieb, Jr., and J. H. Tyler relates to the illumination of street signs by means of incandescent lamps, replacing the steadying resistance in street arc lamps. At present such resistance serves no useful purpose, but according to the patent will be employed in lighting incandescent lamps, which latter may be arranged in a sign lantern supported on the post which carries the arc lamp.

AMERICANIZED STRIKE IN EUROPE.—Even in the methods of conducting strikes European countries are becoming Americanized. In a recent dispatch to the London *Daily Express* from Geneva, Switzerland, riotous scenes are described in connection with a tramway strike in that city, which was brought about, it is stated, by economies effected by the manager of the line, who is an American. A mob filled the streets and prevented the cars from running. They attempted to overturn cars that were manned by non-strikers, and a number of shots were fired. Motors were damaged and the overhead lines were cut. The police are inclined to side with the strikers, whose cry is "Down with the Americans."

STARTING ROTARY CONVERTERS.—Two patents were issued September 30 to B. G. Lamme on a method of starting rotary converters by means of direct current, the voltage of which is less than the normal voltage of the system to be supplied by the machine, but which is more than one-half such voltage. In the case of converters in a distant substation, the e. m. f. there may be materially below the normal voltage, and in starting up the insertion of a resistance to prevent a rush of current from the alternating to the direct-current circuit will prevent the conventer from attaining the desired voltage and speed unless some special disposition is employed, and the patent relates to such a disposition. In the case of a three-phase converter, three star-connected balance coils are employed, which by means of switches may have their outer terminals connected to the collector rings, and the common terminal of the balance coil by means of a switch may be connected to the direct-current line. With full resistance in, the motor is first started in the usual way, and when it has reached the speed due to this condition, the balancing coils are thrown into the circuit, the resistance remaining. The conditions with the balancing coils are then those of half the normal voltage of the converter; the speed is, therefore, increased, and at synchronism the coils are cut out and the normal connection made to the alternating-current circuit.

ELECTRICAL APPARATUS FOR COALING AT SEA.—Two patents, granted September 30 to H. W. Leonard, relate to a method of coaling at sea, which employs the well-known Ward Leonard method of control. Rigged on one of the vessels is a sheave looped, in which is a carrying line, whose two ends are secured to two drums on the other vessel. These drums are connected to two dynamo-electric machines, one of which operates as a motor when the other operates as a generator. The armatures of these machines are in parallel with the source of current supply, and the fields are separately excited. In operation, the machine connected to the taking-up drum acts as a motor, and the machine connected to the drum paying out acts as a generator. When the tension on the cables varies, the loads on the drums will vary accordingly, resulting in a corresponding variation of the counter e. m. f. of the machines, with the result that the machine operating as a motor will automatically take a greater or less amount of energy, producing a corresponding variation of torque and speed; while the machine driven as a generator by the moving cable will produce a greater or less amount of energy, according to the speed of the cable; the result being that the drums pay out the cable faster or slower, according to the variation in tension produced by the rolling or pitching of the vessels. By this arrangement a given tension may always be automatically maintained on the hauling line.

ELECTRICAL STEERING GEAR.—An interesting form of electrical steering gear forms the subject of a patent granted, September 30, to M. W. Day, the principle of which is closely allied to that of the steam steering gear. The arrangement consists of a motor geared to the rudder and supplied with current from a generator having two field-windings wound in opposite directions and two rheostats controlling the supply of current to these windings, one rheostat being controllable by the steering-wheel and the other being mechanically connected to the motor. When both rheostat-arms stand in the same position, the two field-windings are energized by equal currents, and as they oppose each other no current will be generated and the motor will remain at rest; but if the steering-wheel is moved, thereby shifting one rheostat-arm and causing a different current to flow through one field-winding from that in the other, the resulting differential field will generate a current which will start the motor and cause it to shift the rudder and at the same time swing its rheostat-arm until the field-winding connected therewith receives the same current as the other, when the generator-current will cease and the motor will stop. It is evident that this system can be applied to other objects, such as working signals, turrets, train control apparatus and the like.

LETTERS TO THE EDITORS.

Motors in Steel Works.

To the Editors of Electrical World and Engineer:

Sirs.—Your reference in the issue of your paper of September 27 to a paper by Mr. R. M. Darlen, on "Motors in Steel Works," is interesting. His remarks against motors are amusing to one intimately associated with such work.

The writer knows of one steel plant where the motors in service aggregate 8,000 to 9,000 horse-power, and where their use is only limited by the slow rate of extending the station capacity. The work done by these motors covers every step of the process from unloading the ore from boats to the final loading of the finished product on cars; with the single exception of the large roll trains. Even the operation of roll trains by motor power is contemplated in some of the lighter sections.

Usually, power may be obtained very cheaply in the vicinity of blast furnaces, as only a fraction of the waste gases are required to furnish steam for the large blowing engines.

SOUTH CHICAGO, ILL. WM. T. DEAN.

The Effect of Electric Waves on the Human Brain.

To the Editors of Electrical World and Engineer:

Sirs.—The nature of Messrs. McIntosh and Willmore's letter relating to the above subject in your paper of August 23, appears so inconsistent with their first attack on my experiments and so extraordinary from a psychological viewpoint that I feel called upon to affirm and reiterate some of my former statements as well as to deny several of theirs.

First, I reaffirm a "full description of the apparatus they employed would form a unique chapter in wireless." I reaffirm that electric waves acting on cellular matter of the brain cause particles of it to carbonize. I reaffirm that the apparatus I employed was a hundred times more sensitive than theirs, and I reaffirm that the apparatus I described, including a telephone receiver, renders the effect of electric waves on the human brain audible.

Again, I affirm with them, that I am "doubtless aware that brain matter is a complex substance, et cetera." I affirm that Messrs. McIntosh and Willmore are unjustified in trying to determine by mind-reading or guessing, a clue to anything I did *not* say, and in this, as in trying to repeat my experiments, they failed utterly. The clue to my reasoning will be found in what I have written.

Further, I affirm, in the citation "of a case where a man was *beheaded* with a wet towel," their theory is far-fetched, their reasoning erratic and their belief in suggestion marvelous. Admitting that the man died when struck, I reiterate vigorously that unless the blow broke his neck, death was a mere coincidence, and that at the same instant several other men in different parts of the world died and several children were born, and that if a thousand men were operated upon similarly not one would forfeit his life through fear; and I

affirm, too, that many more persons have died from the effects of anæsthetics through the lack of operative skill of practicing surgeons than Messrs. McIntosh and Willmore can show by the record to have died, supposedly from fear.

In conclusion, I deny that these gentlemen disclaim any wish to enter into a controversy, their letters proving the contrary. I deny that the brain substance conducts electrolytically although the cerebral-spinal fluid that surrounds it does; but in these experiments we are dealing with the brain proper and not the solution forming the environs. I must again deny that my method for detecting electric waves was as defective as theirs, for I produced results where they failed. I deny that with apparatus the size they confess to having employed, successful tests could possibly have been made in an ordinary room, and I deny that any instrument too crude to show the deflection of a needle during the tests is "more decisive" than an instrument of the acknowledged sensibility of the telephone—or any other which will give calculations—regardless of whether these are obtained visually or audibly. Their statements are inconsistent when they say they "failed to detect any change of resistance of the brain," and in a few lines below add that "the coherer effect did not amount to one-tenth of one per cent.," and again when they say, "we are inclined to doubt that this (the coherer effect) can be satisfactorily explained by electrostatic stresses in the intervening dielectric." Their explanation of how a storm a hundred miles away may develop or accentuate pathological conditions by the external sensations of light and sound is not plausible.

Until Messrs. McIntosh and Willmore have elucidated their ideas more consistently and described their apparatus fully, I shall deny that they have a case or have proven or disproven anything.

New York City. A Frederick Collins.

DIGEST
of
Current Electrical Literature.

Dynamos, Motors and Transformers.

Heyland Machine.—Heyland.—A very long and well illustrated paper read before the International Society of Electricians, in Paris, on self-exciting alternators of the induction type. The paper does not seem to contain anything that has not been noticed before in the Digest. A very long discussion followed the paper. Boucherot expressed the opinion that the Heyland and Latour machines are of the same type; the resistance, placed by Heyland between the commutator segments, do not make an essential difference, although they may be effective in suppressing sparks at the commutator and change the current flowing through the brushes. Concerning the practical prospects he is somewhat skeptical; for motors he thinks that the gain does not warrant the sacrifice in the simplicity of construction of the ordinary induction motor; for generators the prospects may be better, but experience only can settle this question. Latour explained with the aid of diagrams the action of his machine and made some remarks on the relation between his and Heyland's machine. Janet, Korda and Rey discussed briefly some details. Heyland emphasized that the tests of his motor had clearly shown that his motor is essentially an inductive motor, which is not the case with the Latour motor; he believes, however, that Latour will be able to build good machines without sparks at the brushes, if he follows strictly the modern principles of direct-current dynamo design.—*Bull. Soc. Int. des Elec.,* July.

Transformers for Electrochemical Work.—Peck.—A long, illustrated article in which he discusses the special features of the design of transformers for electrochemical purposes which generally must be capable of delivering extremely heavy secondary currents at widely varying voltages, and which shall have a construction sufficiently rugged to stand excessive overloads for short periods and to operate 24 hours per day without deterioration. He discusses especially the various methods of changing the secondary voltage, the primary voltage being constant. These methods may be divided into two classes: either the ratio between the primary and secondary turns is changed, or an auxiliary transformer is placed in the primary or secondary circuit of the transformer, the auxiliary transformer having a variable voltage ratio, the voltage of which may be added to or subtracted from that of the main transformer. The various possible arrangements are described and illustrated by diagrams.—*Electrochem. Ind.,* September.

Transformers.—An illustrated description of transformers made by the Burnand Transformer Company. A special feature is that the coils are of triangular cross-section, and are on four sides of an iron square built up on stampings. It is claimed that the advantage of this lies in the large surface exposed, the small radial depth of coil, and the shortness of the electrical circuit, without increase in the length of the magnetic circuit. The insulation consists of micanite simply placed round the core and winding, like a postal wrapper, the edges of the insulation projecting well beyond the windings. Movement of the windings sideways on the insulation is prevented by the mutual support between the triangular coils inside the iron square. Every layer is visible after the coil is completed. In case of injury, while in use, any section of the transformer can be replaced, apparently by hand winding, without disturbing any other section.—Lond. *Elec.,* September 19.

Three-Phase Generator.—Some data and diagrams of 500-kw, three-phase generators, ten of which will be installed in a new station near Naples. They are the largest dynamos that have been built in Italy; the number of revolutions per minute is 92.5, and the frequency 40 periods per second. The diameter of the armature is 6.018 m., and the length is 20 cm. The star e. m. f. is 5,000 volts. At normal load the current in each phase is 33 amperes. The magnet system, which serves also as a flywheel, has 52 poles.—*Elek. Zeit.,* September 4.

Lights and Lighting.

Direct-Current Arc with Large Currents.—Rey.—A long illustrated paper read before the International Society of Electricians, in Paris. It is an account of experiments made by Blondel and Rey with direct-current arcs, using more than 25 amperes, such are used in practice for searchlights and similar purposes; the results are given in tables and diagrams, and the two main results are as follows: The intrinsic photometric brightness of the crater of an arc, operated in free air, increases with the current density in the positive carbon. In a series of carbons with different diameters, held at the same temperature by the passage of the current, the current density in the positive carbon varies in inverse ratio with the square root of its diameter.—*Bull. Soc. Int. des Elec.,* July.

Power.

Electric Power in a Paper Mill.—An illustrated description of the electric power installation of the Linwood paper mills in Renfrewshire, N. B. There are two 300-kw, 200-volt, direct-current dynamos. The motor equipment consists of eight 80-hp motors, two of 50-hp and three of 25-hp each. Six of the 80-hp motors drive the beating machine; owing to the sudden and sometimes excessive variation of the load of these machines, it was thought advisable to adopt a belt-drive, and this has proved quite successful. The large calenders are driven by 80-hp motors. The rolls of the calender have to be adapted to suit the various thicknesses of the paper, and the speed has also to be regulated in accordance with the nature of the paper and the degree of finish or surface necessary. To meet these requirements, the calender motors are of the variable speed type, being designed to run at from 100 to 600 r. p. m. A speed of 100 r. p. m. is necessary only for starting the machine, and from 300 to 600 r. p. m. is the average range. The variation can be regulated by the shunts, the loss being negligible, particularly when compared with the wasteful working of the steam engines formerly used. A number of the motors in the mills are geared up to the various machines. After a series of experiments it was decided to use pinions made of paper; these pinions are composed of specially manufactured paper, discs being cut from the web and built up like an armature core; the paper discs forming the pinion are bound together by iron hoods or caps. One of these wheels, about 12 inches diameter, which has been work-

ing into an ordinary spur wheel for the last three years, has given no trouble whatever, and is still in good order. Besides the well-known other advantages of electric driving, the saving in coal alone on this plant will pay off the first costs in about five years.—Lond. *Elec. Rev.*, September 12.

Electric Driving of Machinery.—Broadbent.—An article in which he recommends studying all the conditions carefully before deciding any question of motor driving. Electricity generated by steam power must necessarily be dearer, at the generator, than the steam power itself. It is only in the method of transmission and application that electricity scores; only by getting it directly to the tool or machine, avoiding all unnecessary losses in transit. The ease with which subdivision of electric power can be accomplished, and the ability to connect a motor directly to the machine, not only permits great economies to be effected, but gives such a complete control over individual machines that the output or turnover can be also greatly augmented with little or no addition to standing charges. Subdivision is carried to its highest point in printing plants and in general in plants with machines whch are frequently and suddenly stopped. Concerning regulation, he recommends winding the motor for the maximum power at the middle speed, and speed up by shunt regulation and down by "series regulation." To avoid sparking, it is necessary in order to obtain the best results, to use compound-wound motors for this class of work; the series winding should produce from 20 to 30 per cent. of the total field, the precise amount depending with a varying load, but for most purposes this is unimportant.—Lond. *Elec. Rev.*, September 12.

Small Single-Phase Motors for Factory Driving.—Brief illustrated descriptions of installations of small single-phase motors for power purposes in a tobacco factory and in bakeries. In a tobacco factory there are six motors installed varying from 1 to 3 hp, and running at 1,400 revolutions at 110 volts, the frequency being 50. In a bakery, five motors of ½ to 3 hp are installed, running at 2,800 revolutions, the voltage being 110, the frequency 50. The running cost appears from the data of another bakery as follows: Working week, 44½ hours; price of energy, 4 cents per kw-hour; one 16-hp motor driving biscuit plant and one 10-hp motor driving mixing machines, consumed 106 units per week, costing $4.40; one 4-hp, one 6-hp and one 1-hp motor, driving hoists and spice machines, consumed 70 units per week, costing $2.90; two 4-hp motors, driving dough and cake machines, and one 1-hp motor, driving a biscuit brake, consumed 79 units per week, costing $3.30.—Lond. *Elec. Rev.*, September 12.

Swiss Water-Power Installation.—Bignami.—An illustrated description of the hydro-electric station at Hagneck, which contains five 8,000-volt, three-phase generators. The voltage of the alternators is regulated separately for each machine by interposing variable resistances in the field circuit of the corresponding exciters. A special device allows simultaneous manipulation of the rheostats of all the machines. The voltage can also be changed by manipulating a rheostat in the field of the shunt exciter which feeds the principal exciters. The various localities served by the system take from it about 1,500 kw for motor service, and about 950 kw for lighting. In order to improve the load curve, a carbide factory has been erected which is able to use energy to the extent of 2,400-hp.—*Elec. Rev.*, September 13.

REFERENCES.

Water Power and Electrochemical Industries.—Johnson.—A communication in which he points out that the prospects of electrochemical industries are very bright on account of the large amounts of power being now available at several conveniently located hydraulic installations at very low prices for electrochemical industries. There is also an editorial on this subject in which some statistical data are given.—*Electrochem. Ind.*, September.

Electric Power Plants.—Nearly the whole issue is filled with illustrated descriptions of electric plants for power purposes. Besides the articles which are abstracted elsewhere in the Digest, there are descriptions of electric power installations in a Clyde shipyard, in a coal mine near Manchester, in an engineering and boiler-making plant in Paisley, in a lard refinery in Manchester, in a Bedford manufacturing plant; also articles on the Kalgoorlie electric power and lighting system in Australia, the electric power, light and welding installation at the New Pimlico wheel works, on high pressure oil-break switches, on electric power from blast furnace gas, new power switchboards at the City Road Works in London, the hydro-electric power plant at St. Maurice in Switzerland.—Lond. *Elec. Rev.*, September 12.

Three-Phase Plant in a Welsh Lead Mine.—An illustrated description of the 2,500-volt, three-phase power installation of the Frongoch mine. During the summer months a steam engine drives the generator, while from September to May sufficient water power is available. There are used two 50-hp, two 85-hp and one 35-hp induction motor. About 10-kw is used for lighting.—Lond. *Elec. Rev.*, September 12.

Traction.

Tramcar Brakes.—A long editorial referring to a recent accident in Glasgow, and discussing the problem of brakes for tramcars. In England the hand wheel brake is generally supplemented with slipper brakes. The advantage of the latter over the former is due to the fact that the coefficient of friction between wood and iron is greater than between iron and iron. The slipper brake is recommended for four-wheel cars. But when the profile of the line is such as to make the working of hand brakes, both wheel and slipper, exhausting to the motorman, power brakes should be used; on bogie truck cars, power brakes should always be fitted. The electric brake gives excellent service; it has the great advantage that the wheels automatically release when the braking power is sufficient to skid them. It also responds in a measure to another requirement of a good brake, namely that the power applied should diminish with the speed. The objection to the electric brake is that it requires careful inspection and considerable keep-up, and the further objection that the motors become generators during the braking period, and so do not get the chance to cool that they would otherwise have. In practice, this means that the motor capacity, where electric brakes are used, must be at least 20 per cent. in excess of what it otherwise would be. The air brake for tramway service is coming into quite general use in the United States and in continental Europe; it is recommended to work an air pump placed on the car by means of an electric motor which is automatic in its action, so that when the pressure in the tanks falls below a given amount, the motor is started and continues running until it is automatically cut off when the pressure reaches the desired amount; the principal objection to this method appears to be the first cost. It is best practice to use power brakes regularly and the hand brakes only as a reserve. Motormen should be fully trained in handling the brakes.—Lond. *Elec.*, September 12.

An "All-Station Express."—Brown.—An abstract of a British association paper, in which he proposes the following system of electric express railways. He contemplates an express train running without a single stop from end to end of the line. In order to serve intermediate stations, it is proposed that, on the approach of an express to any one of these stations, passengers desirous of joining the express should enter a railway carriage standing still at the platform, on the same track as that on which the train is approaching. The system of traction being electrical, the guard on this stationary carriage, on the near approach of the express, will start the carriage in motion in the same direction as the express is moving, gradually getting up speed. In time the express will catch up to the single carriage, and coming into contact without a jolt, will be automatically coupled to it. This operation is to be operated at every station. Means are, moreover, provided by which a passenger on the trains may alight at any desired station, for the rear coach on the train is detached and brought to a standstill as each station is passed. A working model of this railway was exhibited. Prof. Perry described his own invention in this form of railroading, in one modification of which the station platforms are made to spin round until they have the same velocity as the passing train; passengers merely step from platform to train.—Lond. *Elec.*, September 19.

REFERENCE.

Automobiles.—An illustrated description of several electrically-propelled motor cars of English make.—Lond. *Elec.*, September 19.

Installations, Systems and Appliances.

Maintenance of Direct-Current Motors.—Mayes.—An article on the up-keep of the direct-current motor and its accessories. The most serious and frequent causes of trouble are overheating of the armature winding with consequent destruction of the insulation, and failure in the field coils. To avoid overheating of the armature winding, proper fuses should be used; and he points out that there are five principal factors governing the carrying capacity of a fuse:

its cross-section, the nature of the metal used, length between the terminals, mass of metal contained in the terminals, and to a small degree the temperature of the surrounding atmosphere. If all these factors are properly taken into account, the fuse can be made a reliable apparatus, and the actual time and current limit can become definite known quantities. Concerning the failure of the field coils, he considers that dampness is mostly responsible; hence motors should be placed in a dry situation, and if this is not possible, the whole of the field coils should be treated with hot paraffin, applied preferably in the process of manufacture. He also gives some brief notes on the maintenance of brushes and commutators and on the main starting switch.—Lond. *Elec. Rev.*, September 12.

Electro-Chemistry and Batteries.

Electric Resistivity of Steel and Pure Iron.—Benedicks.—An account of tests of steel made in the electric furnace in Gyringe. This steel is very homogeneous and free from gases. He found that chemically equivalent quantities of different materials, dissolved in iron, increase the electric resistivity by the same amount; this is correct, for *C, Si,* and *Mn*; according to Wedding also for *P*; according to Le Chatelier also for *Wo,* and according to Barrett, Brown and Hadfield also for *Al*. One dissolved (gram) atom per 100 (gram) atoms of solution, increases the resistivity by 5.9 microhms for a cubic centimeter, which is in agreement with the measurements of Le Chatelier. Carbide in iron has no appreciable influence. The resistivity of absolutely pure iron at ordinary temperature is 7.6 microhms for a cubic centimeter.—*Zeit. f. Phys. Chem.*, v. 40, 5; abstracted in *Elek. Zeit.*, September 11.

Gaseous Discharge in a Rotating Magnetic Field.—Chabot.—An account of an experiment which is an extension of Leher's experiment with a conductor in a rotating magnetic field, a vacuum discharge being in this case substituted for the wire. The magnet used was a bell electromagnet, and against its central piece was mounted a vacuum tube so that the magnetic field between the center and the circumference of the bell magnet traversed the tube radially. The current thread in the vacuum tube revolved about the magnet pole in the usual manner, as discovered by Ampere, making about one revolution per second. The magnet and tube were then set in rotation about a vertical axis, the connections being kept up by means of sliding contacts, and it was noticed that the rotation had a well-marked influence upon the magnetic rotation of the current thread, contrary to what was the case with the wire. The rate of rotation was sensibly accelerated by mechanical rotation in the same sense, and retarded or even reversed by a mechanical rotation in the opposite sense. On suddenly reversing the direction of rotation, it was noticed that the portions of the discharge nearest the electrodes changed first, and that the middle portion was dragged round apparently with reluctance. No induced currents produced by the alteration of the rotation were noticed.—*Phys. Zeit.*, September 1; abstracted in Lond. *Elec.*, September 12.

Absorption of Projected Electrons.—Seitz.—An account of an investigation of the fact that the absorption of cathode rays by thin metallic plates decreases when the discharge potential, *i. e.*, the velocity of the projected electrons, is increased. The coefficient of absorption is inversely proportional to the fifth power of the velocity, or to the 2.5th power of the difference of potential.—*Phys. Zeit.*, September 1; abstracted in Lond. *Elec.*, September 12.

Cathode Fall.—Baker.—An account of an investigation of the cathode fall and ultra-violet light. The cathode fall of potential or negative drop, is the difference of potential between the cathode and the outer limit of the dark cathode space. According to Stark's theory, the normal cathode fall represents the ionizing energy of the positive ions, and varies with the gas and the metal, as well as with other circumstances. It is small in the case of the chemically active metals, as these have a great "catalytic" power upon the formation of free positive ions. The present author has endeavored to produce some effect upon the cathode drop by using a polished zinc plate, as in photo-electric experiments, and illuminating it with ultra-violet light. He found that the ultra-violet light produced no effect upon the negative drop, nor did the change of current amount to one-half of a per cent. But a marked effect was produced in the potential required to start the discharge; in a case quoted, the reduction was from 558 to 510 volts; the effect was due to an action upon the cathode, and not to a volume ionization of the gas.—*Proc. Cambridge Phil. Soc.*, Easter, 1902; abstracted in Lond. *Elec.*, September 12.

Ionization of Solutions.—Cunningham.—An account of experiments in which he attempted to ionize solutions by ultra-violet light and Röntgen rays, but with a negative result. Such an ionization would shed some light on the disposal of the energy absorbed by a substance with an absorption spectrum. He experimented with Carey Lea's solution of collodial silver and various other solutions. No distinct increase of conductivity, apart from the temperature effect, was obtained with ultra-violet light. With Röntgen rays, however, he obtained a distinct though small effect in a solution of Hoffmann's violet, in a dilute solution of collodial silver, and in an ammoniacal solution of silver chloride. No effect was found in uranyl or silver nitrate.—*Proc. Cambridge Phil. Soc.*, Easter, 1902; abstracted in Lond. *Elec.*, September 12.

Electro-Physics and Magnetism.

Concentration Cells.—Carhart.—An abstract of an A. A. A. S. paper, in which he gives a thermoelectric theory of concentration cells. A concentration cell may be considered as a device for converting the heat of the surroundings into electrical energy. He has also found the law that the thermo-electromotive force increases with the concentration of the solution; hence the thermoelectric forces on the two sides of a concentration cell do not balance each other, and the difference is the electromotive force of the concentration cell. This law is also applied to the theory of the Daniell cell, and is shown to explain some facts concerning it. There is also an editorial, giving a review of the development of the theory of the galvanic cell in general and of the concentration cell in particular.—*Electrochem. Ind.*, September.

Ionic Velocities in Liquid Ammonia Solutions.—Franklin and Cary.—An account of measurements of the electric conductivity of salts dissolved in liquid ammonia, which show that such solutions carry the current with remarkable facility, surpassing in this respect even aqueous solutions. There is a rapid increase in the molecular conductivity with dilutions up to a final high value, which is interpreted as meaning that in the more concentrated solutions the salts are dissociated to a much smaller degree in ammonia than in water, and that to complete the dissociation in ammonia solutions the dilution must be carried much higher than in the case of aqueous solutions. If liquid ammonia solutions are to meet the requirements of the theory of electrolytic dissociation, it is necessary to assume that the ions in this solvent travel at a much greater speed than they do in aqueous solutions. He has measured directly the ionic speeds in liquid ammonia at 33° C., the results showing that these speeds are indeed about three times the speeds in aqueous solutions at 18 degrees.—*Electrochem. Ind.*, September.

Aluminum Alloys.—Wilson.—A British association paper on the electrical conductivity of certain aluminum alloys as affected by exposure to the London atmosphere. The specimens are in the form of wire, 0.126 in (3.2 mm.) diameter, supported on a wooden frame; they were exposed on the roof of a building for 13 months. It is assumed that the observed effects are principally due to pitting at the surface, but exposure might also affect the structure. The position of aluminum in the electrochemical series with respect to the other substances used is as follows: *Al Mn, Zn, Fe, Ni, Cu, Si.* It should be expected that copper, widely separated as it is, would be effective in the production of corrosion. This is found to be the case, the effect increasing with the percentage of copper. Nickel is well separated from aluminum in the series, and alone has considerable effect, but if alloyed with copper the conductivity increased slightly during exposures. This specimen is specially promising, as it has a breaking load of 45,900 lbs. and limit of elasticity 36,600 lbs. per square inch. It has a comparatively low percentage extension, a high coefficient of expansion, and a low temperature coefficient for electric resistance. Again, iron in the presence of nickel has slightly increased conductivity. The results of the analysis of the different experiments before and after exposure are given in a table. For exposed light, aluminum alloys it appears that copper alone should not be used in the alloy; the presence of equal amounts (about one per cent.) of nickel and copper certainly reduces conductivity by a small extent, but the increase in mechanical and the decrease in corrosive properties is great.—Lond. *Elec.*, September 19.

Graphite Electrodes in Electrolytic Work.—Collins.—An article in which he first gives a summary of the results obtained by tests of the relative value of graphite and other forms of electrode material in various lines of electrolytic work, concerning the chemical properties and the corrosion of the electrodes; as well known, graph-

ite is generally much superior to other forms of carbon. He points out that graphite shows also a decided superiority in its adaptability to machinery, its purity, high electric conductivity and other physical characteristics. Graphite electrodes can be machined with the greatest ease; several practical forms of electrodes are described and illustrated.—*Electrochem. Ind.*, September.

Resistance Furnace with Platinum Foil.—HAAGN.—A German Bunsen Society paper on electric furnaces for laboratory purposes, made by Heraeus with platinum foil of 0.007 mm. thickness. The furnace is said to be very easily adjustable, by insertion and variation of a series resistance. The tubes on which the platinum foil is mounted are best made of china or glass; magnesia is not suitable for high temperatures, as it begins to become a good electrolytic conductor. He has obtained a temperature of 1,700 degrees for a short time; the china then gets soft; the furnace can be made for any voltage up to 220; lower voltages are better for very high temperatures. In the discussion Heraeus said that he has succeeded in making a non-electric furnace in which temperatures up to 2,200 degrees can be produced; he uses for this purpose an iridium tube, which is placed in a suitable way in a line furnace; it is heated by means of an oxyhydrogen flame. The temperature was measured by means of a thermocell, consisting of wire of absolutely pure iridium against an alloy of 90 per cent. of iridium with 10 per cent. of ruthenium; this cell was compared up to 1,650 degrees with a thermocell calibrated by the Reichsanstalt, and the higher values were "calculated."—*Zeit. f. Elektrochemie*, July 31.

A Principle of the Design of Galvanic Cells.—The first of a series of articles on electrochemical theories, illustrated by examples from practice. The following experiment of Oswald is discussed. Well amalgamated zinc does not dissolve in a solution of sulphuric acid, but it does if in contact with platinum. If a vessel with two compartments is used, separated from each other by a porous condition, a zinc rod and a platinum wire being placed in the two compartments, respectively, and being connected together outside, then the question arises to which compartment acid is to be added in order to start the dissolution of zinc. The experiment shows that the acid must be added to the platinum compartment, which is somewhat unexpected. The explanation of this fact is shown to give a general principle of the design of galvanic cells, as the above arrangement represents an electrochemical system. The question is first discussed which chemical reactions can represent an electrochemical system, and the answer is: only those in which there is a change of valency, *i. e.*, in which there is oxidation and reduction, but not, for instance, equations which represent double decomposition. In order that by a chemical reaction of the former class, chemical energy is really changed into useful electrical energy, it is further necessary that the material to be reduced is at the cathode and that to be oxidized at the anode; if they are brought together directly, heat is developed instead of electrical energy. In Oswald's experiment the zinc is to be oxidized and the hydrogen is to be reduced from the sulphuric acid, hence the sulphuric acid is to be added to the platinum compartment. This principle is applied to the explanation of several commercial galvanic cells.—*Electrochem. Ind.*, September.

REFERENCES.

Niagara as an Electrochemical Center.—RICHARDS.—The first part of a very long and well-illustrated article on the electrochemical industries of Niagara Falls. The installations of the plants are described, and the process used are explained in detail. The present part deals with the power houses and the following electrochemical plants: Castner Electrolytic Alkali Company, Niagara Electrochemical Company, Norton Emery Wheel Company, United Barium Company, Oldburg Chemical Company, Ampere Electrochemical Company, Electrical Lead Reduction Company, Roberts Chemical Company, A. J. Rossi, National Electrolytic Company, Atmospheric Products Company, and Union Carbide Company. The article is to be concluded.—*Electrochem. Ind.* September.

Electrolysis of Sodium Chloride.—TOWNSEND.—An article in which he discusses the influence of diffusion in the electrolysis of sodium chloride. For the production of caustic and of chlorine the essential point is to keep these products apart, and to permit the accumulation of the caustic to a reasonable concentration, yet to prevent so far as may be its movement by diffusion into the anode solution. He gives an outline of and discusses critically, the different methods used for this purpose which may be divided into the following classes: diaphragm cells, gravity cells, and the use of a liquid metal cathode to absorb the sodium as separated.—*Electrochem. Ind.*, September.

Electrochemical Oxidation.—ELBS.—A brief German Bunsen Society paper on the electrochemical preparation of $(NH_4)_2\,Pb\,Cl_6$, using a carbon and a lead anode simultaneously. The general principle of thus using two different anodes, one being non-polarizable and soluble, while the other is inert—can be applied for many purposes.—*Zeit. f. Electrochemie*, July 31.

Atomic Theory.—DIVERS.—A note on his presidential address to the chemical section of the British Association, on "the atomic theory without hypothesis." His aim is to show how "the exposition of even advanced chemistry, in its symbolic, equally as in its ordinary language and nomenclature, is independent of any hypothesis as to the mechanically and chemically differentiated structure of substances, and that chemistry can be studied and still further developed without reference to such a structure."—Lond. *Elec.*, September 19.

Cuprous Ions.—BODLAENDER.—A brief German Bunsen Society paper on the chemistry of cuprous compounds. Among other things he found that the cuprous ions are monatomic, not diatomic.—*Zeit. f. Elektrochemie*, July 31.

Education of Electrochemists.—BURGESS.—An abstract of a paper on electrochemistry as an engineering course. A knowledge of the properties of materials of construction and of the transformations, distributions and utilization of various forms of energy is essential for an electrochemical engineer, and such knowledge can best be obtained in an engineering course, conducted along much the same lines that are followed in electrical mechanical or other engineering courses.—*Electrochem. Ind.*, September.

A New Electrochemical Journal.—The publication of a new journal, entitled "Electrochemical Industry," has been begun; it is published monthly in Philadelphia; it is the first journal on this subject in the United States, and the second published in the English language. It is to be devoted to both the industrial and the scientific interest. The articles in the present issue, which contains 42 pages of reading matter, are all original, and of a high order of merit; they are or will be abstracted under their respective headings in the Digest. The regular departments, besides correspondences, book reviews, trade and personal notes, include the following: An analysis of the U. S. electrochemical patents of the month, a synopsis of articles in other journals by Carl Hering, being similar to the Digest but containing longer abstracts; reports of meetings of societies; and a digest of U. S. electrochemical patents prior to July, 1902, by E. A. Byrnes and C. P. Townsend. The editor is E. F. Roeber.

UNITS, MEASUREMENTS AND INSTRUMENTS.

REFERENCES.

Measurements of Power in Alternating-Current Circuits.—RHODES.—An illustrated article in which he describes the following three methods: the three voltmeter method, the three ammeter method, and the split dynamometer method.—Lond. *Elec. Rev.*, September 5.

Oscillograph.—DURAND.—An illustrated description of a recent type of the Blondel oscillograph. One of the main improvements is the use of a vibrating band in place of an iron strip mounted on pivots, which was not entirely satisfactory, especially for high rates of vibration.—*Elec. Rev.*, September 13.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCES.

Wireless Telegraphy.—TURPAIN.—A long illustrated article describing recent experiments made by Ferrie and Tissot.—*L'Eclairage Elec.*, August 23, September 6.

Wireless Telegraphy.—An illustrated description of the principles and instruments of the Slaby-Arco system.—*Elec. Rev.*, September 27.

Berlin.—ARENDT.—An illustrated description of the Telephone Exchange III in Berlin, which is designed to ultimately connect 14,000 subscribers.—*Elek. Anz.*, August 10, 14.

MISCELLANEOUS.

Engineering Education.—PERRY.—The conclusion of his address the first part of which was recently abstracted in the Digest. All boys of fifteen ought to possess three powers: To use books and to enjoy reading: to use mathematics and to enjoy its use; to study nature sympathetically. The main study in the college should be in the laboratory, where every student should make quantitative experi-

ments; he does not recommend large and elaborate machines for students' laboratories. The difficulty about all laboratory exercise work is that of finding demonstrators and assistants who are wise and energetic. In an electrical engineering laboratory the elementary principles are made part of a pupil's mental machinery by many quantitative experiments. The cry for technical education is simply a protest against the existence of unskilled labor of all kinds. "There is far too much unskilled labor among workmen and foremen and managers, and especially in owners. There may be some kinds of manufacture so standardized that everything goes like a wound-up clock, and no thought is needed anywhere; but certainly it is not in any branch of engineering. Many engineering things may be standardized, but not the engineer himself. Millions of money may build up trusts, but they will be wasted if the unskilled labor of mere clerks is expected to take the place of the thoughtful skilled labor of owners and managers." He strongly urges a reform of engineering education in England.—Lond. *Elec.*, September 19.

Electric Currents in Plants.—RIES.—An account of experiments relating to Waller's observation that if a leaf is placed on a glass plate between zinc electrodes, and one-half of it is illuminated, while the other half is wound with black paper; then an electric current passes from the illuminated portion of the dark portion, especially under the red rays which are absorbed by chlorophyll. Waller believes this current to be due to a direct photo-electric action of the light upon the leaf. The present author gives a number of reasons for believing that it is a photochemical current of a non-physiological nature. In the first place, it is not necessary that the leaves be green to show the effect. Furthermore, no current is indicated when the electrodes themselves are covered. The effect also depends upon the material of the electrodes. When copper or silver electrodes are substituted for the zinc electrodes the current is reversed, and it is greatly reduced by carefully cleaning the electrodes. The effect is practically the same when the electrodes are dipped into the juice of the leaves instead of being in contact with them. He believes the phenomenon to be identical with the photochemical currents observed by Hankel, Schmidt and others, and to be mainly due to the sodium, potassium and calcium compounds contained in the plants. The effect is enhanced by chlorophyll, just as it is by a variety of other dies and pigments.—*Phys. Zeit.*, August 15; abstracted in Lond. *Elec.*, September 19.

REFERENCES.

Volcanoes and Electricity.—BOEHM-RAFFAY.—An article on the electric phenomena during the eruption of Mount Pelee on Martinique.—*Zeit. f. Elek.*, September 7.

Biographical.—The beginning of a series of biographical sketches of pioneers in electrochemistry. The present one gives an account of the life and work of C. M. Hall, with portrait, the inventor of the Hall aluminum process.—*Electrochem. Ind.*, September.

New Book.

SELF-PROPELLED VEHICLES. A Practical Treatise on the Theory, Construction, Operation, Care and Management of all Forms of Automobiles. By James E. Homans, A .M. New York: Theo. Audel & Company. 632 pages, 466 illustrations. Price, $5.00.

This volume is advertised as being intended for owners, operators, repair men and intending purchasers of automobiles, and certainly forms the best treatise of this nature that has so far been issued. It might have been added with perfect justice that it would be found of interest to manufacturers of self-propelled vehicles as well, as there are probably but few of them who could read it through without finding some hints of practical value. It is gratifying to be able to record that the book shows no evidence of being the compilation of trade catalogues that has been so glaringly noticeable in other volumes on the subject. It is true that when a purchaser is making his final decision it is convenient to have assembled at one point a complete description of any given machine, but this is the function of a trade catalogue.

The chapters on the theory of steering and turning automobiles are exceedingly good, and sure to clear up many points that perplex amateurs. That on speed changing and reverse gears for gasoline cars is also commendable as explaining a subject of which the average person has but little idea.

While the chapters on electrical vehicles are hardly up to the standard of the rest of the book, the author must nevertheless be complimented on his success in setting forth in simple language the fundamental principles. His illustration of torque of a motor is particularly happy.

Of course the book is by no means perfect. In one portion, for instance, the author advocates blowing out the gauge glass on a steam machine by opening a drain cock at its lower end, something that is impossible with almost all steam vehicles, as they are provided with self-closing valves, which would shut under these conditions, and it is very easy to forget to reopen them afterward. A certain type of boiler is very favorably mentioned without a warning being inserted, calling attention to the fact that it cannot be drained, and is hence very liable to burst in winter. The diagrammatic symbol used for an electric condenser is also anything but conventional.

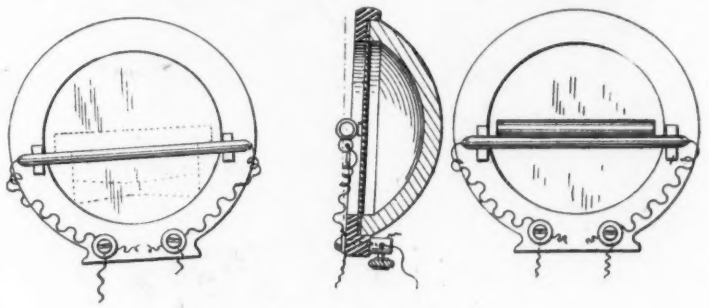
Some of the "freaks" included might well have been left out, so far as their intrinsic merit goes; but, after all, in future years a book like this will serve a further purpose for consultation from the historical standpoint. The automobile art is advancing so rapidly, it seems probable that few of the best types herein described can long survive as exemplars. We note that all the types of vehicles shown are for pleasure or passenger traffic. Our own idea is that some of the very best electrical work has been done on industrial vehicles, and that when electricity comes to its own, it will be found very prominent in doing much of the heavy work still left to that anachronism of modern city life, the horse.

While the press work is good, the illustrations as a rule are very poor indeed, and detract from the otherwise handsome appearance of the volume.

Gally Telephone Transmitter.

In our issue of December 7, 1901, we noticed briefly two telephone patents, granted November 26, 1901, to Merritt Gally, well known as an inventor, particularly in telegraphy. The subject of the patents is a form of telephone transmitter differing widely from the usual types. This transmitter is now being shown in operation at offices in the Fulton Building, corner Fulton and Nassau Streets, New York, and we give below a description in fuller detail.

There is nothing in the transmitter corresponding to the electrodes in the ordinary type. Instead of electrodes and loose particles of carbon, the circuit is completed through a solid piece of high-resistance conductor, such as carbon, which is attached to the back of the diaphragm mounting, without touching the diaphragm. Loosely resting upon this high-resistance conductor, and having no electrical connection therewith other than the contact due to its own weight, is a short piece of a better conductor, such as metal, which shunts more or less current around the higher resistance of the poor conductor, according to the nature of the contact. The vibrations of



GALLY TELEPHONE.

the diaphragm, due to the sound waves, are communicated to the loose conductor by means of two projections extending from the back of the diaphragm. The motion of the loose conductor upon the fixed one causes variations in the contact, and consequently in the current, which flows as usual through the primary of an induction coil.

The sensitiveness of this transmitter is very great. With one cell of dry battery it transmits the faintest whisper in a very perfect manner, and a faint watch tick quite distinctly. On the other hand, it is impossible to scream into the transmitter loudly enough to break or mar the transmission. Conversation in a low tone of voice in any part of the room where the transmitter is situated can be distinctly heard in the receiver in an adjoining room.

From one point of view this transmitter is a return to first principles; that is, there is only one loose piece, as in the Hughes micro-

phone and the Blake transmitter. The transmission, is however, incomparably better than with the Blake transmitter, and there is a fundamental difference between Mr. Gally's invention and other transmitters, namely that it works by more or less completely short-circuiting a fixed resistance placed in the main circuit, other transmitters varying the main circuit resistance directly. The accompanying cuts show the construction so clearly that further description is unnecessary.

"Ceco" Electrical Machinery.

The Christensen Engineering Company, Milwaukee, has just placed upon the market complete new lines of "Ceco" electrical machinery, including direct-current motors and generators, alternators and transformers.

For several years this company has been manufacturing electric motors for driving air compressors used in connection with the well-known Christensen air-brake equipments on electric cars. More than 6,500 of these motors are in highly satisfactory service throughout the world. The company has also built a large number of motors of various capacities for driving air compressors used in general commercial service, and all the motors for driving machine tools and shafting in their own works.

In order to manufacture these motors the company has maintained an extensive equipment particularly suited to the purpose. Some time ago it was decided to greatly increase the company's manufacturing facilities and to develop a complete line of electrical machinery of the highest grade.

The policy of the Christensen Engineering Company has always been not to place any apparatus upon the market until the entire work of development has been satisfactorily completed. The high reputation and remarkable success of the air-brake apparatus are largely due to this policy. Therefore, the company has made no announcement regarding its electrical apparatus until the various lines were completely developed and severely tested, and the company considers that the results have proved that these machines are in design, construction and performance worthy of the high reputation now accorded to the Christensen air-brake equipments. The company is now prepared to build machines up to 1,500 kw in capacity, suitable for general power, railway or lighting service.

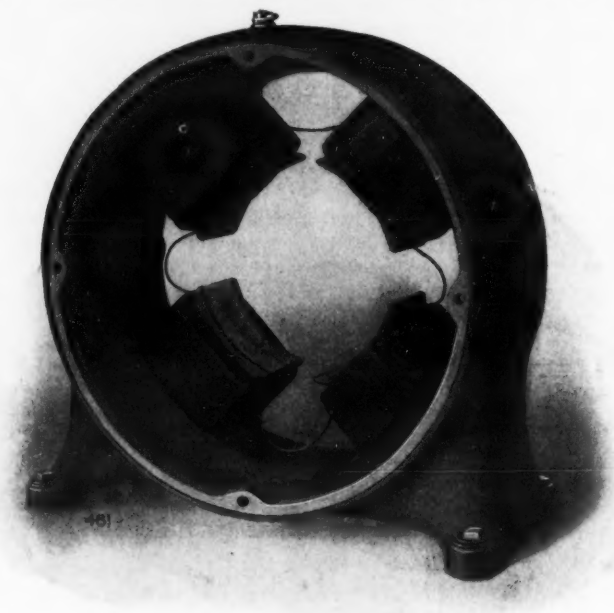


FIG. 1.—MOTOR FIELD.

The line of "Ceco" motors known as "Type C. E.," ranging in capacity from 2 to 50 hp, is illustrated herewith. These motors are made in three styles, open, semi-enclosed and enclosed. The standard styles are belted but any motor can be geared or direct connected to the driven machine or shaft. The C. E. motors are for general service in industrial establishments of every kind where a high-grade, durable and reliable machine in required.

The frame or magnet yoke to which the poles are secured is cylindrical in shape. It is composed of a single steel casting. The bearing brackets are secured to the frame by bolts. The terminals are mounted on top of the frame, where they are not liable to be accidently touched, but where they are readily accessible in case it is desired to change the connections in order to reverse the direction of the motor. The two bearings are supported by two end brackets which are identical and interchangeable so that the motor is symmetrical

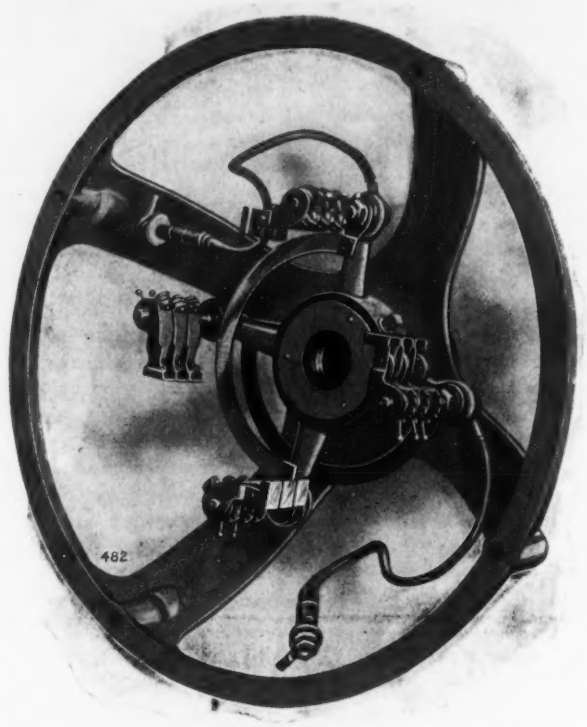


FIG. 2.—MOTOR-BEARING BRACKET AND BRUSH HOLDER.

and pleasing in appearance. The semi-enclosed style is the same as the open, but with the addition of four perforated malleable iron cover plates. The plates fit into the four open spaces between the arms of the end brackets, and can be quickly and easily removed or replaced. The enclosed style is the same as the semi-enclosed except that the cover plates are solid instead of perforated. Either style

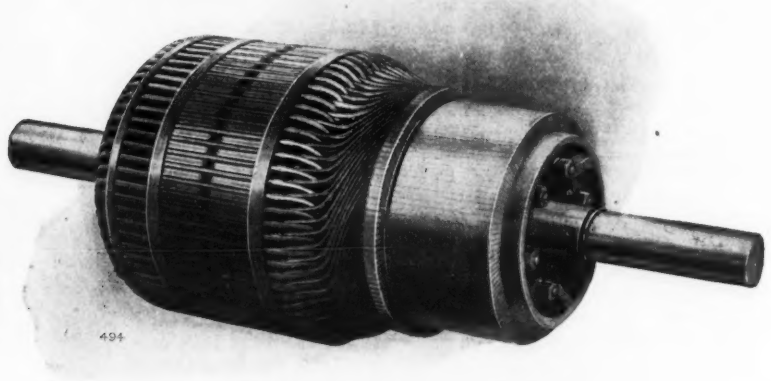


FIG. 3.—MOTOR ARMATURE.

of cover plates will fit into the open-style motor, consequently the same motor may be used as open, semi-enclosed or enclosed.

The field poles are built of laminated sheet steel, thereby avoiding eddy current losses. The larger machines have four poles, and the smaller sizes are built with two only, thus permitting the use of a commutator that can be insulated far more satisfactorily than is possible in small machines of the usual four-pole construction. The poles are bolted to the yoke so that a rigid construction is obtained, and the pole is easily removable without disturbing the armature.

The field winding is composed of machine-formed coils, accurately wound by automatic machinery. Any field coil can be readily and

quickly removed without disturbing the armature by simply withdrawing the pole as explained above. The armature core is built up of punched discs of soft sheet steel, slotted around the periphery to receive the armature winding. These discs are reannealed and insulated after being punched, before assembling. The shape of the punching is such, that when assembled on the steel shaft openings are

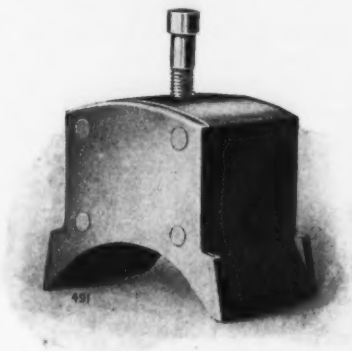


FIG. 4.—MOTOR POLE PIECE.

FIG. 5.—MOTOR FIELD COIL.

provided for ventilation parallel to the shaft. Additional ventilation is secured by the use of radial air ducts.

The armature coils are all machine wound. Those for the smaller motors are of wire, while those for the larger sizes are composed of copper bars. The coils are all carefuly insulated, then dipped into a bath of special insulating compound, and finally placed in a drying oven until they are thoroughly baked. Surface bands are used to retain the coils in the slots on the smaller sizes, while the same result is secured in larger sizes by the use of retaining wedges placed in specially provided notches near the top of each slot.

As the core and poles are constructed of soft laminated steel, it is evident that the magnetic circuit which consists of these three elements, is of the highest permeability and the efficiency of the motor is, therefore, correspondingly increased.

The commutator is built up of copper segments insulated from each other by sheets of the highest grade of mica, of hardness corresponding to that of the copper, so that a smooth and even wearing surface is presented to the brushes. Pure hard-drawn lake copper is used. The segments are of generous length and depth, insuring cool running, and allowing ample margin for wear. The commutator is easily removable from the armature shaft, tapped holes being pro-

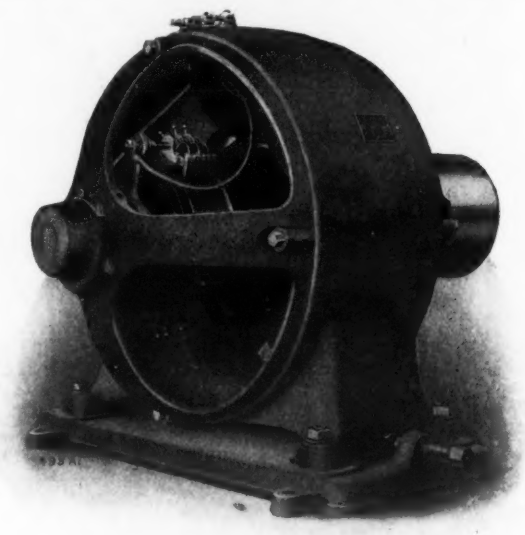


FIG. 6.—"CECO" MOTOR.

vided in the face of the commutator sleeve for that purpose. As the commutator is usually the cause of more trouble than all other parts of a motor combined, unusual care has been given to the design and construction of this important element of "Ceco" motors.

Carbon brushes are used, and the brush holders are of the Christensen Company's coil spring, reaction type. They are very simple in design, and absolutely reliable in operation. The brush holder studs to which the holders are secured are mounted upon a yoke, which is fastened to the inner side of the bearing bracket. Each brush can be readily adjusted, and any brush can be quickly and easily removed while the motor is running. The brush contact area is in all cases ample for the current to be commutated, the current density being very low and at the same time consistent with economical design. Wear of the commutator is provided for by radial adjustment of the brush-holder studs. After the brushes are properly set no shifting is required, and the motor operates without noise and without sparking.

The bearing surfaces are generous in area. Self-aligning, babbited bearings with the well-known self-oiling ring arrangements are provided. The motors are mounted on a cast-iron sub-base, which is composed of a single casting, thus insuring perfect alignment. Belt tension is accomplished by moving the motor upon the sub-base in the usual manner.

The ventilation of the armature and commutator is remarkably good, thus insuring a low temperature while running continuously. The "Ceco" motors will operate at their rated loads without the temperature of the armatures rising more than 30° C. The rise in temperature of the field coils under these conditions will not exceed 40° C. and of the commutator 45° C. These machines will operate from no load to full load with the brushes in a fixed position without sparking. They will also operate for two hours with 25 per cent. overload, and for two or three minutes with 50 per cent. overload without injurious heating or sparking.

These motors will operate in any position in which the shaft is horizontal. This is accomplished by shifting the bearing brackets on the frame so that the oil chambers remain in the proper position, whether the motor is secured to the floor, the ceiling or the side wall.

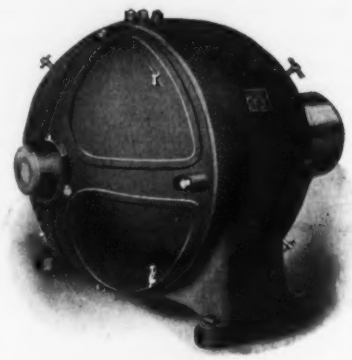
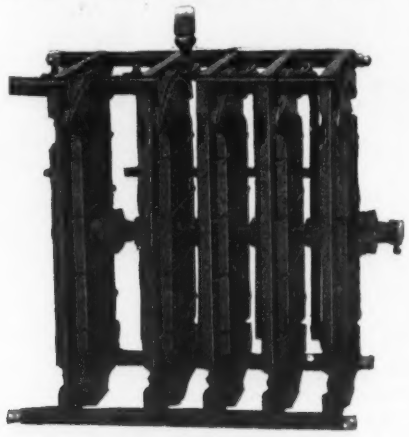


FIG. 7.—ENCLOSED "CECO" MOTOR.

A rigid system has been established for the inspection of the parts of each machine while under construction, and there is no poor material or workmanship to hide under canvas, rope or other "protecting" material. When completed, each machine is given a severe running and high-insulation test. Then the frame is rubbed with a good filler and painted. All bright parts are polished, so that in addition to being compact in design, substantial in construction and superior in performance, each machine presents a graceful and pleasing appearance.

Printing Press Motor Control.

A controller for printing press motors has recently been made by the Ward Leonard Electric Company, of Bronxville, N. Y. It is illustrated herewith. The principal point aimed at in this controller



PRINTING PRESS MOTOR CONTROL.

is the elimination of the objectionable arcing and burning of the ordinary types of controllers for this purpose. This is accomplished by the use of a very high resistance divided up into a large number of steps. The difference in voltage between the consecutive contacts

is reduced by this means to a figure at which no sparking can possibly occur. The motor is stopped by the gradual insertion of this high resistance, and the circuit is never opened upon the controller. The cut shows a controller for 12½ hp. These controllers are made upon the multiple unit system by combining any desired number of unit 2½-hp controllers. Each one of the plates shown is complete with its own switch, contacts and resistance.

In many new installations, it is extremely difficult to predetermine exactly the current the work will require, and the controller when installed may be found to have too small or too large current capacity with correspondingly improper ohms. With the multiple unit construction for the controller, it is a very simple matter to add additional plates or disconnect those not needed, while with the controllers in general use an entirely new controller would be required if it is sought to make the ohms and ampere capacity exactly suited to the power actually taken by the motor in practical operation.

A New Deflecting Fan Motor.

The growing popularity of fan motors which deliver their breeze over a large area instead of constantly in one direction and over one circumscribed space, has greatly stimulated invention in this field; and the result is seen in some very ingenious devices. We illustrate and describe herewith the "Palm" fan motor, which is being put upon the market by the Coleman Manufacturing Company, of 111 Fifth Avenue, New York City. This ingenious mechanism has been devised and very fully patented by Mr. Walter E. Coleman, an inventor of repute in other lines of industrial development. The general idea hitherto worked upon in deflecting fans has been that of rotating or swiveling the motor itself, involving, of course, the construction of a motor and apparatus to perform such movement. In the Coleman device, any motor will answer the purpose, and the ordinary fan guard itself becomes an integral part of the deflecting

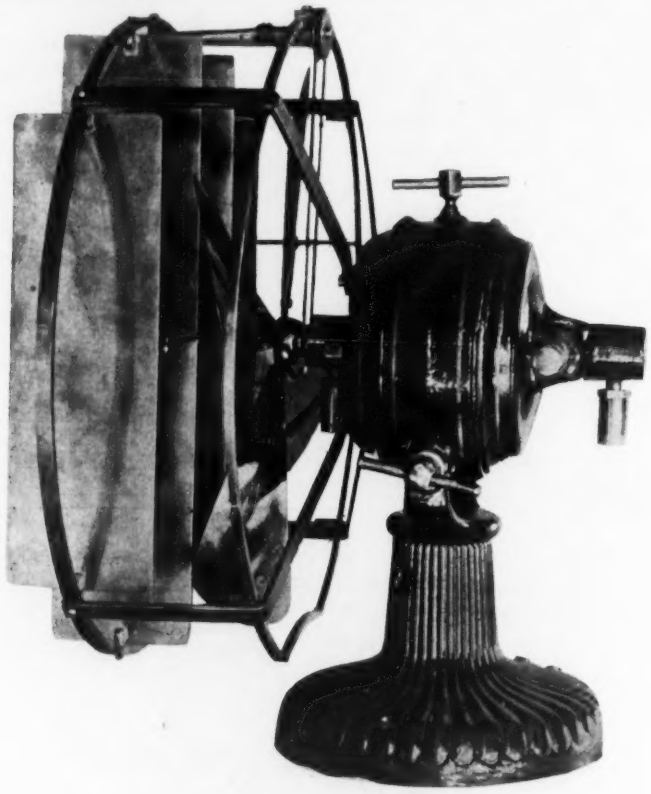


FIG. 1.—DEFLECTING FAN MOTOR.

mechanism. Mr. Coleman accomplishes his purpose in a variety of ways, all ingenious and practicable. In the form shown in Figs. 1 and 2, and now being introduced, an extra pulley of small size is fixed on the extension of the armature shaft, on the fan side, and belted up to another pulley driving a compact worm gear, by whose movement the deflector blades are swung from side to side within the guard rims, slowly or swiftly as may be desired. The amount of power consumed to deflect the blades is so slight that a thin rubber band sufficies as a driving belt between the two pulleys. Usually a coiled wire belt is employed. As will be observed, the worm communicates motion to a small toothed wheel that carries a reciprocating rod in engagement with the deflectors in front of the fan.

Another interesting form of mechanism devised by Mr. Coleman for controlling and distributing currents of air from a fan motor comprises arrangements, by means of which a single worm gear and its connections turn the motor on its axis and change simultaneously the inclination of the deflectors with relation to the motor.

It is interesting to note that the Coleman fan herewith illustrated

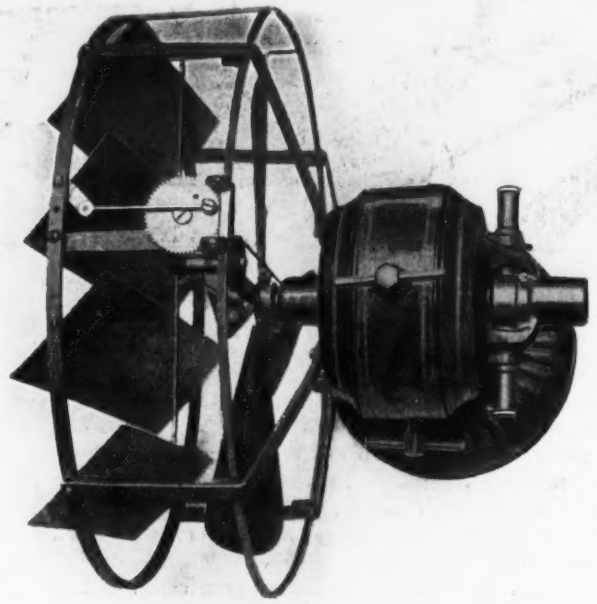
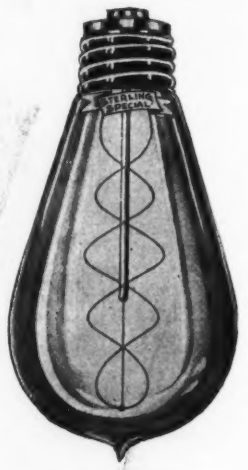


FIG. 2.—DEFLECTING FAN MOTOR.

can be run at any angle, the worm being positive in its drive on the gearing, so that the motor can be tipped up and hung around to deliver its breeze straight ahead, or towards the ceiling or downward to the floor. The device is not only inexpensive but a mere tyro can attach it in a few minutes to any fan motor as easily as he could an ordinary guard.

New Form of Incandescent Lamp.

An interesting new form of incandescent lamp has recently been invented by Glenn C. Webster, of Warren, Ohio, and put on the market by the Sterling Electrical Manufacturing Company, of that place. It is illustrated herewith, and as will be noted there is a double spiral filament, or actually, on account of the central member two spirals. The aim of the inventor has been to produce a lamp with a maximum symmetrical distribution of rays, yielding the same candle-power virtually at every point in the vertical and horizontal planes. The glass bulb used is of usual character. From the top is sealed a pendent glass member, at the lower end of which is an anchor, thus constituting part of the glass mount, the anchor being of wire, the lowest loop of the filament being attached to it. To this anchor, it is stated, the carbon particles shed by the filament are drawn or attracted statically, instead of bombarding the glass bulb and discoloring it in the familiar way.



INCANDESCENT LAMP.

As will be observed, the three convolutions of the filament are of different shapes and sizes. Seen from below, or in an end view, the convolutions appear in different horizontal planes, and each can throw its light downward without any interference from either or both of the two other ones. A maximum volume of light is thus secured in a downward direction, while the sidewise, lateral distribution of light rays is also uniform. The bulb presents a highly luminous aspect, suggestive rather of a globe of light, like an enclosed arc, than of the ordinary incandescent filament in its distinctly seen shell of glass. The cut shown illustrates the new lamp so clearly that few words are needed to point out the manner in which the inventor has sought to achieve his object.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Time money was in better supply, 6 per cent with commission being demanded. In the stock market more strength developed as a result of the relief of the financial stringency through the action of the Treasury Department. The strength of the market, however, is not accepted as indicating any settled feeling on the part of Wall Street interests; a bull campaign is looked upon as possible at any time. The favorable condition of business and the large earnings of the railroads seem to furnish a basis for expectations that no very serious decline can occur, and that with a return to easier conditions in the money market, renewed appreciation may be seen in the stock list. In the industrial list, the chief feature of prominence was the tendency of United States Steel shares to rally on small transactions. The traction stocks gained ground with the rest of the market, Manhattan being particularly strong, owing to the belief in the increase of the company's earning power following the completion of the electrical installation. This stock reached 138¾, closing at 135¾, the lowest price being 132. Metropolitan Street Railway reached 142½, but dropped and closed at 139, the lowest figure of the week, being a net loss of 3 points. Brooklyn Rapid Transit recorded a net loss of 2¼ points on the week's business closing at 64, which was 2 points below the highest quotation. General Electric closed at 185, which is a net decline of 5 points, the lowest and highest quotations being 182 and 188½, respectively. Westinghouse lost 6 points, closing at 217. Western Union's range of the week was between 90 and 93⅞, the closing price being 92½, a net loss of 1½ points. Commercial Cable was dealt in at 170½, which is 2¼ points below the last previous quotation. American District Telegraph stands alone in the electric list, with a net increase to its credit, the amount being 2 points, the closing price being 39. In Boston, Western Telephone was added to the regular list of stocks dealt in. Following are the closing quotations at New York of October 7:

NEW YORK.

	Sept. 30.	Oct. 7.		Sept. 30.	Oct. 7.
American Tel. & Cable.	—	92	General Electric	187	180
American Tel. & Tel.	—	165	Hudson River Tel.	—	108
American Dist. Tel.	—	36	Metropolitan St. Ry.	142¼	136½
Brooklyn Rapid Transit	66	61½	N. E. Elec. Veh. Trns.	¼	—
Commercial Cable	—	—	N. Y. & N. J. Tel.	157	160
Electric Boat	25	23	N. Y. E. V. T. Co.	13	12½
Electric Boat pfd.	40	35	Tel. & Tel. Co. Am.	—	—
Electric Lead Reduc'n.	3¼	2¾	Western Union Tel.	93⅞	90¾
Electric Vehicle	5¼	—	West. E. & M. Co.	218	200
Electric Vehicle pfd.	14	10	West. E. & M. Co. pfd.	—	210

BOSTON.

	Sept. 30.	Oct. 7.		Sept. 30.	Oct. 7.
American Tel. & Tel.	167	163½	Western Tel. & Tel. pfd.	100	98½
Cumberland Telephone	—	—	Mexican Telephone	2⅛	2⅛
Edison Elec. Illum.	277	275*	New Eng. Telephone	139	139
Erie Telephone	—	—	Westinghouse Elec.	108	102
Western Tel. & Tel.	28	—	Westinghouse Elec. pfd.	108	—

PHILADELPHIA.

	Sept. 30.	Oct. 7.		Sept. 30.	Oct. 7.
American Railways	52½	52½	Phila. Traction	98	98
Elec. Storage Battery.	—	—	Phila. Electric	8⅞	8⅝
Elec. Storage Bat'y pfd.	—	—	Pa. Elec. Vehicle	—	—
Elec. Co. of America.	10	9½	Pa. Elec. Vehicle pfd.	—	—

CHICAGO.

	Sept. 30.	Oct. 7.		Sept. 30.	Oct. 7.
Central Union Tel.	—	—	National Carbon pfd.	101	100¾
Chicago Edison	—	—	Northwest Elev. com.	36½	36
Chicago City Ry.	215	212	Union Traction	17½	17
Chicago Tel. Co.	—	—	Union Traction pfd.	48⅝	50
National Carbon	32	30			

* Asked.

GENERAL CARRIAGE SCANDAL.—In a suit brought by Joseph Leiter, against the members of the former brokerage firm of Thomas & Post and others, to recover for the stockholders of the General Carriage Company the sum of $1,110,000, he charges the defendants with having wrecked that corporation, which went into the hands of a receiver in May, 1901. Mr. Leiter makes sweeping charges of fraud, and papers in the case have been served upon General Samuel Thomas, Edward R. Thomas, Orlando F. Thomas, Edwin M. Post, Camille Weidenfeld, Cyrus Field Judson, Joseph S. Tracy and Winfield S. Jewell. All of these defendants, according to the plaintiff, except E. R. Thomas, were directors of the Chicago company in January, 1901, while the three Thomases and Mr. Post composed the firm of Thomas & Post. Mr. Leiter declares in his complaint that the valuable piece of property on Sixth Avenue, from Forty-third Street to Forty-fourth Street, owned by the company and mortgaged for $800,000, was fraudulently and illegally transferred to the firm of Thomas & Post in cancellation of a debt of $50,000, although the equity was worth much more. In the same month, Leiter charges, the directors—composed largely of the members of the firm of Thomas & Post—sold to that firm 50,000 shares of treasury stock for 80 cents a share. At that time, he says, shares were worth $4 each, and before the fraud had been discovered by Leiter and other stockholders had risen to $23, making a value of $1,150,000 for the block, which was sold for $40,000. By this transaction, Leiter declares, Thomas & Post made great profits, and the other directors, too, he claims, participated in and received benefit of the fraud and losses to the company.

MANHATTAN ELECTRIC TRACTION.—Ten electric trains are now being run on the Sixth Avenue Manhattan line, terminating at Fifty-eight Street, and it is understood that for three or four weeks no attempt will be made to place an electric service on the section of the line running to 155th Street. Earnings continue to increase gratifyingly, and it will probably be found that the quarter ended September 30, shows a larger gain in gross than has been shown in any other quarter. The increase in traffic on the East side lines, due to the introduction of electric equipment, is estimated at not less than 10 per cent. This is said to be a very conservative estimate, but should equally good results follow the change of power on the West side the effect on Manhattan earnings would be very important. According to the quarterly statements the system earned last year $7,808,661 gross, $5,518,584 net, leaving a surplus after charges of $3,073,405, which is equal to 6½ per cent. on the stock. Should electric operation of the entire system result in increasing the gross earnings 10 per cent., the increase would be $1,066,591. It has been estimated that the saving in operating expense will be in the neighborhood of $1,100,000 per annum, but assuming that some slight effect of this was felt in the later part of the year, and allowing for a loss in other income derived from money loaned in the street, the saving might still be in excess of $500,000. An increase in gross of $1,066,591 coupled with a decrease of $500,000 in expenses would indicate a surplus of $4,639,996, or 9.6 per cent., as the earning capacity of Manhattan under electric operation.

THE AUGUSTA TROLLEY DEAL.—A special dispatch from Baltimore, Md., says: Interests identified with the Railways and Light Company of America, who are also the controlling owners in the North Augusta Electric and Improvement Company, of Augusta, Ga., and the Augusta-Aiken Electric Railway have consummated the purchase in this city of a majority of the stock of the Augusta Railway and Electric Company, of Augusta, Ga. The purchasers are as follows: J. W. Middendorf & Co., of Baltimore; John L. Williams & Sons, of Richmond, Va.; John Blair MacAfee, of Philadelphia; Alfred S. Elliot, of Wilmington, Del., and James W. Jackson, of Augusta, Ga. The Augusta Railway and Electric Company owns the entire street railway and electric light properties of the city of Augusta, Ga. The control of the company was bought from Messrs. Jarvis & Conklin, of New York, and Colonel D. B. Dyer, of New York. Its capital stock is $1,000,000, and it has $1,000,000 of bonds outstanding.

BELL TELEPHONE OUTPUT.—The American Telephone and Telegraph Company instrument statement for the month ended September 20 and since December 20 shows:

	1902.	1901.	1900.
Gross output	75,011	75,578	44,190
Returned	43,334	33,482	30,948
Net output	31,677	42,096	13,242
Since December 20:			
Gross output	808,334	683,171	501,354
Returned	346,689	301,289	220,903
Net output	461,645	381,882	280,457
Total outstanding	2,987,251	2,334,698	1,860,956

DIVIDENDS.—The directors of the Philadelphia Company have declared a dividend of 1½ per cent on the common stock, payable November 1. A quarterly dividend of 1¼ per cent. has been declared on the preferred stock of the Georgia Railway and Electric Company, payable October 15.

TELEPHONE EXTENSIONS.—Dispatches from Tacoma state that the Northwest Telephone and Telegraph Company has placed $400,000 bonds in New York and will proceed to build lines through Western Washington.

TROLLEY MILLION MORTGAGE.—It is stated that the Philadephia, Bristol and Trenton Street Railway system has mortgaged its property for $1,000,000.

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of trade all indicate an exceptionally good business for Fall, orders already booked being in most cases in excess of preceding years, and crop reports, except in some sections, guaranteeing the full volume of business in the remaining months of this year and the early part of 1903. In the Northwest, merchandise sales generally exceed those of last year, and collections are good; a large Fall business is indicated on the Pacific Coast, where collections are better, and except for a few scattered pessimistic reports from the South, advices from that section are generally of a fair to good trade with improved productions. New Orleans is an exception, owing to numerous strikes already declared or threatened, and retail business is reported paralyzed thereby. Less strength is noted in some lines of the iron and steel business than heretofore, but the quieting-down in the cruder form is due to scarcity of fuel and of pig iron, necessitating shut-downs of steel mills, as much as to the flood of foreign iron, which appears to be steadily increasing. The receipts of foreign iron and steel in August exceeded 140,000 tons, though it may be pointed out in this connection that exports of iron and steel and their products, mostly machinery, are still more than double the imports for that month. Copper ruled quiet but steady throughout the week, the range of prices being confined to narrow limits. The closing quotations are Lake 11⅝ @ 11¾c., electrolytic in cakes, wire bars and ingots 11⅜ @ 11½c., cathodes 11⅛ @ 11¼c., and casting stock 11⅜ @ 11½c. *Bradstreet's* reports 164 business failures during the week ending October 2, as against 172 the week previous, and 175 the same week last year.

HARRISBURG ENGINE ORDERS.—The Harrisburg Foundry and Machine Works, of Harrisburg, Pa., have just received a contract through their New York offices, 203 Broadway, for a 190-hp standard engine, to be direct connected to a 125-kw Westinghouse alternating-current generator, for installation in the Danville, Va., plant of the American Tobacco Company. The equipment will be used for lighting and motor work. A 150-hp standard engine for direct connection to a 100-kw Bullock generator has been ordered for lighting purposes by the Harlem Amusement Company. Two 60-hp standard engines, each to be direct connected to 40-kw generators, built by the Western Electric Company, are to be installed for lighting use in the new Webster Hotel, West Forty-fifth Street, New York. The Y. M. C. A. Building, at Newark, N. J., is to be equipped with two 75-hp standard engines for direct connection to Western generators of 50-kw capacity each. These outfits are intended to be utilized for electric light. A 50-hp Ideal engine, to be direct connected to a 30-kw Crocker-Wheeler generator, has been requisitioned for installation in the Cushman Building, Broadway and Maiden Lane, New York, for lighting use. The United States Government has ordered a 25-hp Ideal engine, to be direct connected to a 17½-kw Westinghouse generator, for the Quartermaster's Department, at Manila, Philippine Islands.

MORE SUBSTATIONS FOR NEW YORK.—Plans have been filed with the Building Bureau, of New York City, for two of the power stations of the Rapid Transit underground road, respectively at 29, 31 and 33 City Hall Place and 108 and 110 East Nineteenth Street. They are to be three-story structures with cellars. They will have two large entrance doors and façades of granite and limestone with terra-cotta trimmings. The two upper floors will contain the electric operating machinery. The City Hall Place station will be 58.2 feet front and 199.10 feet deep, with an extension 57 x 81.43 feet. The Nineteenth Street station will be 50 feet front and 92 feet deep, with an extension 49.10 x 79 feet. Each building is to cost $60,000. Plans have also been filed by the subway architects for an inspection shed, to cost $95,000, to be built for the use of the underground road, fronting on 148th Street, east of Seventh Avenue. It is to be of brick and steel, with a glass roof, and will be 338 feet front and 199.10 feet deep.

BALL ENGINE CONTRACTS.—C. O. Lamson, Waterloo, Ia., has recently put in operation a direct-connected unit. The Ball Engine Company, Erie, Pa., furnished the engine, and the Westinghouse Electric and Manufacturing Company, Pittsburg, the generator. The Pennsylvania Railroad Company, G. R. & I. division, Fort Wayne, Ind., has recently purchased a Ball engine for electric service. The Pueblo Electric Company, Pueblo, Colo., has recently purchased an additional unit from the Ball Engine Company. The Detroit Iron and Steel Company, Detroit, Mich., has placed an order with the Ball Engine Company for three 350-hp engines, each arranged for direct connection to a generator. These units will be used in its electric power plant.

LIGHTING PROPERTIES IN WASHINGTON, D. C.—A deed has been placed on file by the United States Electric Lighting Company, conveying all its property, assets and franchises to the Potomac Electric Power Company. The consideration named in the deed is but $10, but it is understood that it was a $3,250,000 deal. It is also explained that the prime cause for the transfer being made is that the charter of the United States Electric Lighting Company expires at once. It is also explained that the Potomac Electric Power Company is to pay all the debts of the other corporation. It is stated that the property transferred to the Potomac Electric Power Company is subject to a trust of $650,000 due the Guaranty Trust Company of New York.

IMPORTANT EXPORT TELEPHONE SHIPMENT.—One of the most important export shipments recently was a large invoice of telephone equipment for two complete public service telephone exchanges for the cities of Port Arthur and Fort Williams, Ont. The shipment consisted of two 1,000-line multiple-capacity International lamp signal central energy switchboards, with all necessary central office apparatus and subscribers' telephones, including two Roth charging machines and ringing generators, with General Electric motors, and two sets of chloride accumulator storage batteries, by the International Telephone Manufacturing Company, of Chicago.

LIGHTING PLANT FOR JAPANESE HOTEL.—The Japanese house of Takata & Co., whose New York address is 10 Wall Street, has just secured another contract for a complete plant for lighting use in Japan. The outfit is intended to be installed in the Oriental Palace Hotel, at Yokohama. It will consist of a 25-kw Westinghouse generator, to be direct connected to an Ideal engine built by A. L. Ide & Son, of Springfield, Ill. The pumps will be furnished by the Knowles branch of the International Pump Company. The exhauster is to be supplied by the Burt Manufacturing Company, of Akron, Ohio. A Cross oil filter has also been ordered.

WESTINGHOUSE SCOTCH CONTRACT.—A cable dispatch from Glasgow, of October 3, says: A £500,000 contract has been placed with the Westinghouse Company by the Clyde Valley Electrical Company, of Glasgow, for the equipment of two generating stations to supply power for industrial purposes over an area of 755 square miles. The initial installations are to be of 6,000 hp each, and are to be completed within eighteen months. These will be the first of a series of great power stations to be built in the United Kingdom.

SWITCHBOARD WORK.—C. L. Sherman, 1026 Filbert Street, Philadelphia, is completing a switchboard for the new Commonwealth office building in that city. This board consists of six panels of blue Vermont marble, with a slate base, and is about 13 ft. x 8 ft. in size. Weston instruments and I-T-E circuit breakers are being used. Among other work recently completed by Mr. Sherman is the switchboard and 24 tablet boards, enclosed in cabinets, for the five new Carnegie Library buildings, Washington, D. C.

THE CINCINNATI PLANER COMPANY, Cincinnati, Ohio, continues to make extensive improvements to its plant and equipment. It is now installing a 150-hp boiler, a 50-kw generator and a 25-hp motor; 14-inch and 18-inch Lodge & Shipley lathes, 36-inch Schumacher & Boye lathe, 48-inch G. & E. automatic gear cutter, 16-foot Bridgeport automatic screw lathe, Owen Miller, 3-foot and 5-foot Fosdick radials, Higley cold saw and several of its own planers. It reports a steady run of orders.

INTERCOMMUNICATING TELEPHONES.—A contract for an intercommunicating telephone system for the Boston Athletic Association has been placed with Sargent, Conant & Co., Boston. The same firm has also finished recently the complete electrical equipment of Mr. T. W. Lawson's "Dreamwold," at Egypt, Mass., including telephones, arc and incandescent lights, wiring, etc. All the distributing circuits are carried in underground ducts throughout the estate.

INQUIRIES FOR MOTOR CARS FOR N. S. W.—The United States Export Association, Gerken Building, West Broadway, New York, has secured inquiries for motor cars, which are intended to be utilized on an extensive scale for the purpose of transporting the mails in New South Wales. The same concern has also received inquiries for naphtha launches for Russia.

ELECTRICAL EQUIPMENT FOR B. & O. SHOPS.—Considerable purchases are about to be made for electrical equipment to be installed in various shops of the Baltimore and Ohio Railroad. Thayer & Co., Incorporated, of 39-41 Cortlandt Street, New York, the local sales agents for Cahall boilers, have just been allotted orders aggregating 2,500 hp.

LARGE ELECTRIC HOISTING EQUIPMENT FOR BUENOS AYRES.—The Export Club, 82-88 Wall Street, New York, has received an inquiry from Buenos Ayres for a large electric hoisting equipment, which is intended to be used on the docks of that Argentine port.

LARGE INDIAN WATER-POWER SCHEMES.—Mr. J. N. Tata, of Bombay, who is now in this country, is primarily interested in two large Indian water-power projects, the carrying out of which may result in the placing of very considerable contracts for equipment on this side. The larger scheme is to utilize the waters of the Doodh Sagar, located about 300 miles north of Bombay, at a point where there is a water-fall no less than 2,600 feet in height. It is proposed to construct reservoirs so as to take advantage of the heavy rains which fall seven months of the year in that region. It is estimated that fully 50,000 hp would be thus available all the year round. It is intended to furnish energy to operate some 60 miles of railroad. The other project Mr. Tata and his friends have in hand is one to furnish electric power to Bombay, for the purpose of working the electric traction system under contemplation, and supplying energy for manufacturing and general purposes in and around that city. It is proposed to construct an hydraulic plant at Neral, located some 40 miles from Bombay. The General Electric Company and the Swiss firm of Escher, Wyss & Company are reported to be after the contract. Mr. Tata, who will be in the United States for some five weeks, has been at the Holland House, New York, and at the offices, 82-88 Wall Street, of Tata & Company, of which firm he is head.

THE ELECTRIC LAUNCH COMPANY, of Bayonne, N. J., has had an exceptionally busy season the past summer, more electric and gasoline powered launches having been shipped by it than ever before. At present it has under construction two 45-foot steam launches for the War Department, and ten men-of-war boats for the Brazilian navy, besides a number of electric launches for delivery in the late fall and early spring months. The electric-powered boat is becoming very popular in yacht tender service, the many advantages of safety, seaworthiness and availability for immediate use making it particularly adapted for such work. The company's electric passenger launches have proved to be paying investments in connection with street railway pleasure resorts and summer hotels. Two 42-foot launches have been supplied to the Omaha & Council Bluffs Railway and Bridge Company, with a seating capacity of 70 adults or 92 children each, which at ten cents a head shows good returns on the investment when the low cost of operation is considered; one man, usually a motorman, operating the boat. The current for recharging is obtained from the trolley road.

WATER POWER IN OREGON.—The Condor Water and Power Company, Tolo, Oregon, has recently been incorporated with a capital stock of $100,000. Officers: Dr. C. R. Ray, president and general manager; W. F. Hunter, secretary. The water power plant is a dam and ditch construction, which will develop 6,000 hp. An order has been placed with the General Electric Company for some of the electrical machinery, and some McCormick water turbines have been ordered through Col. Frank H. Ray, second vice-president of the Continental Tobacco Company, New York, who is the principal stockholder. The purpose of the company is to supply power and light for the adjoining towns and villages and to the mines, both quartz and placer, in the vicinity, and to supply water for towns, villages and for mining and irrigation. To carry out these plans, quite a good deal of machinery, supplies and materials will be needed; most of which as yet has not been ordered. Dealers and manufacturers are requested to send catalogues and prices to Dr. Ray.

CAR BODIES FOR SOUTH AFRICA.—The Durban Municipal Council, South Africa, is reported to have made objection to the acceptance of the tender of the British electrical engineering and contracting firm of Macartney, McElroy & Company for additional trolley cars at £10,000, on the ground that a British firm actually manufacturing cars should be given the preference. The mayor explained that the motors would be British make, but the car bodies would have to be procured from America as they were urgently wanted. Hitherto, the major portion of the cars have been built in England, 22 having been turned out at the George F. Milnes shops. The equipments were of General Electric build, and the trucks were manufactured by the J. G. Brill Company. Last spring, as noted in these columns at the time, eight cars were ordered through Macartney, McElroy & Company, which were completely built in this country, the J. G. Brill Company making the bodies and trucks and the General Electric Company furnishing the motor equipments.

BRITISH GET SHANGHAI TRACTION CONTRACT.—The Shanghai Municipal Council has at last come to a decision regarding the electric traction system which is to be built in the foreign settlement of that Chinese city. The contract has been awarded jointly to the British Brush Electrical Engineering Company, Limited, and the British Electric Traction Company, Limited. Construction work will be begun almost immediately on some nine miles of double track and 8½ miles of single track. The overhead trolley system is to be used. The voltage will be 500-550. There will be from 50 to 60 cars. Single deck ones are proposed, each seating six first class and 40 second class passengers. The rails will be 90-pound girder. The gauge is to be 4 feet 8½ inches. The franchise is for 21 years, after which the Council may purchase on certain conditions. It is expected that by the end of 1904 the system will be ready for traffic. The cost of construction, etc., is put at $1,500,000.

EQUIPMENT FOR BRAZILIAN ELECTRIC ROAD.—The City of Santos, Brazil, is to have an electric traction system. The electrical engineering and contracting firm of James Mitchell & Co., of Rio Janeiro, have secured the contract. The initial length of the road will be about 10 miles. The power house equipment is to consist of two 200-kw General Electric generators, direct connected to 300-hp engines manufactured by A. L. Ide & Son, of Springfield, Ill. The boilers will be Babcock & Wilcox. The pumps are to be furnished by the Worthington branch of the International Pump Company. The car bodies are to be built in Brazil, owing to the cheapness of wood in that part of the world. The trucks will be furnished by the Peckham Manufacturing Company, whose New York offices have lately been removed to the Engineering Building, Liberty Street. The motor equipment will be built by the General Electric Company.

ELECTRICALLY EQUIPPED PRINTING PLANT FOR LONDON.—Edward Lloyds, Limited, of London, proprietor of *Lloyds' Weekly* and the *London Daily Chronicle*, is to erect a mammoth printing plant on the site of its existing works, in Salisbury Square, London, W. C. The plant will be equipped with American machinery. The motive power will be electric exclusively. George W. Mascord, the chief mechanical engineer of the British concern, is now here for the purpose of placing contracts. The equipment will entail an expenditure of more than half a million dollars. The plant when completed will be by far the largest newspaper printing establishment in Great Britain. Mr. Mascord is making his headquarters at the New York offices of Edward Lloyd's, Limited, in the Broad Exchange Building, 25 Broad Street.

POWER FOR A SHOE FACTORY.—It has been decided by the United Shoe Machinery Company to accept the offer made by the city of Beverly, Mass., to build a huge plant, to cost $750,000, and to occupy ten acres and employ at least 2,000 operatives. The company has organized a committee to carry on this work. The plant will include an administration building, 60 x 80 feet, three stories high, two parallel main manufacturing buildings, 600 x 60 feet, three stories high; a storage building, 400 x 60 feet, three stories high; a drop forge, blacksmith, die sinking and hardening plant, 60 x 220 feet; a 20-ton daily foundry plant, and a central power plant of 1,800 hp. Industrial and underground railways will connect the various buildings, and the whole plant will be electrically driven. All the factories will be consolidated in this big plant.

FOR A 6,000-HP MEXICAN HYDRAULIC PLANT.—The Yaqui Copper Company, 377-379 Broadway, is about to let contracts for the equipment of a 6,000-hp hydraulic plant at its mines, in the State of Sonora, Mexico. The company is to build a 5,000-ton smelting plant there, to be operated by electricity, as will all other machinery in the property. The head will be 112 feet. About three miles of pipe line, varying from 2½-inch to 5½-inch steel pipe, will be constructed. W. P. Harlow, of Nogales, Arizona, is president of the company. He is now a guest at the Waldorf-Astoria. M. E. Harby, lawyer, of 25 Broad Street, New York, is vice-president. The secretary is Geo. E. Green, of Binghamton, N. Y. The capital of the company is $5,000,000.

EQUIPMENT FOR ANOTHER JAPANESE ROAD.—The Tokio Street Railway Company—a Japanese capitalized concern—which is about to construct an electric traction system some 20 miles in length in the city of Tokio, is at present letting contracts for various equipments. Frazar & Company, of Japan, whose New York offices are at 63-65 Wall Street, has been awarded the contract for 100 car trucks and motor equipments. The power to operate the road will be furnished by the Tokio Electric Light Company.

ELECTRICAL EQUIPMENT, ETC., FOR CHINESE DOCKS.—The Hong Kong & Whampoa Dock Company, Limited, of China, will shortly let contracts for the supply of electrical equipment, machine tools, etc., for an extension of its docks. The contracts will probably be awarded through the firm of Shewan Tornes & Company, of China, 16 Beaver Street, New York.

AMERICANS AFTER JAPANESE ROAD.—The Hanqin Electric Railway Company, of Japan, which was recently organized for the purpose of constructing an electric traction system between Osaka and Kobe, is entering into negotiations for the introduction of American capital. Japanese advices state that a Mr. Tison is acting for A. N. Brady in the matter.

POLICE TELEPHONES WANTED.—Police Commissioner Partridge, of New York, has asked for $170,000 for extra telephones and telephone supplies.

General News.

THE TELEPHONE.

SAN FRANCISCO, CALIF.—The Commercial Pacific Cable Company is constructing its underground land line to connect its cable landing near the Cliff House with the Postal Telegraph Commercial Cable offices in San Francisco. The distance to be covered is 6¾ miles. The conduits consist of 3-inch wrought iron pipe into which the lead-covered cable will be drawn. The cable testing-house near the beach is almost completed.

BOISE, IDAHO.—The employees of the Rocky Mountain Bell Telephone Company in the States of Montana, Idaho and Utah are on strike for an increase of wages.

CHICAGO, ILL.—It is stated that the International Union of Commercial Telegraphers has been formed here by a convention of 40 delegates representing as many cities.

LA FOUNTAINE, IND.—The La Fountaine Telephone Company has increased its capital $15,000 and will make extensive improvements.

WABASH, IND.—The Home Telephone Company, of this city, whose exchange was destroyed by fire two weeks ago, has restored the plant and resumed business.

PERU, IND.—The entire system of the Home Telephone Company, of this city, was rendered useless on Sept. 26 by a fire, which started from a candle, burning the main switchboard.

COLUMBIA CITY, IND.—A scheme is on foot for the consolidation of the independent telephone exchanges of South Whitley, Cherubusco and this city. The consolidated interests will make extensions and improvements.

RUSSIAVILLE, IND.—A community system is being organized by the farmers of this section. A switchboard will be installed at Russiaville and free connection will be made with Forest, Frankfort, Middlefork, New London, Kokomo, and other towns.

BROWNSTOWN, IND.—The Brownstown Telephone Company has been purchased by Henry Rust, William Robinson, and Elmer Brown. The purchasers will make improvements and extend the system throughout the surrounding territory.

ELWOOD, IND.—The new telephone exchange was put in operation in this city Sept. 18. At the same time the toll lines connecting Elwood with Alexandria and Anderson were thrown open to the public and the Muncie line will be opened as soon as the new exchange there is completed.

EVANSVILLE, IND.—The Cumberland Telephone Company is advertising for new patrons and making preparation to connect with other lines and otherwise to continue its service to the public, regardless of the action of the council in declaring its franchise expired and ordering it to cease business and remove its poles and wires within ninety days. The city will attempt to remove the poles at the expiration of the ninety days.

INDIANAPOLIS, IND.—The Monroeville Home Telephone Company has filed articles of incorporation with the Secretary of State. The capital stock is $10,000; directors: S. E. Mentzer, G. E. Speke, S. B. Walters, G. W. Muma and S. L. Ashton. The company will construct telephone lines and telephone exchanges in Allen and contiguous counties. The franchise includes the right to use telegraphy should it decide to do so in the future.

RICHMOND, IND.—The New Long Distance Telephone Company, of Indiana, and the Richmond Home Telephone Company have brought suit against the Richmond Interurban Railway Company to enjoin it from constructing a system of high-tension feed wires between Richmond and Dublin. The three wires are to connect the power house in Richmond with apparatus at Dublin to reduce the voltage. The court has granted a temporary restraining order and the work which was nearing completion has been stopped. The case will be heard October 8.

DES MOINES, IA.—The Whittmore Telephone and Electric Light Company has been organized with a capital of $10,000.

EDDYVILLE, IA.—The Eddyville Telephone Company has incorporated with $15,000 capital.

PADUCAH, KY.—The People's Telephone Company, which will soon commence operations here, has secured an option on the Alexander line and will give connection with Smithland and other towns in that vicinity. It will be necessary to string a large cable across the Tennessee River. An exchange will probably be established at Smithland.

FOWLERVILLE, MICH.—Business men of this place propose to organize a co-operative telephone company.

LANSING, MICH.—The Michigan Telephone Construction Company, of Alma, with a capital of $75,000, has filed articles of incorporation.

KALAMAZOO, MICH.—The Kibbie Telephone Company is about to enter this city. The company is capitalized at $50,000 and stock is owned by farmers and business men of neighboring towns. Six years ago the system was started on a small scale by J. H. Tripp and it now covers a large district in this section of the State.

DETROIT, MICH.—A citizen's committee, composed of J. E. Scripps, Joseph Harris, T. G. Craig, J. B. McKay, Ralph Phelps, W. H. Ellis and others, has petitioned the city council to repeal the franchise granted to the People's Telephone Company, and ask that another franchise be granted to the citizens committee to be transferred by it to another company to be formed by the consolidation of the properties of the People's Telephone Company and the Co-operative Telephone Company.

HANNIBAL, MO.—The Bluff City Telephone Company, of Hannibal, has filed articles of incorporation. The capital stock is $100,000. The incorporators are J. C. McCoid and H. C. Conger, Mount Pleasant, Ia.; Claire W. Manatt and C. H. Brown, Grinnell, Ia.; B. E. Hixon, R. L. Hixon and V. T. Strong.

JEFFERSON CITY, MO.—City Counselor R. J. Ingram has procured an alternative writ of mandamus, returnable Oct. 14, to test the right of Kansas City to regulate the rate the Missouri-Kansas Telephone Company shall charge in the city. The company refused to put in telephones unless the rates of $96 for business and $72 for residence telephones are paid. The council recently passed an ordinance reducing the rates and fixing them at $60 for business telephones and $36 for residence telephones. The legality of the council's action is to be tested.

OMAHA, NEB.—A popular vote will probably be taken on the question of granting a franchise to the Interstate Independent Telephone Company. This company, which has a capital stock of $100,000, proposes to establish an independent telephone system in the tri-cities, Omaha, South Omaha, and Council Bluffs.

COHOES, N. Y.—The Waterford Home Telephone Company is constructing a line between this place and Waterford.

HAMBURG, N. Y.—The Haines Telephone Company is forming a system of the local telephone companies in this vicinity which will connect with the Frontier Company.

LANCASTER, N. Y.—The Lancaster Telephone Company has been incorporated, capital stock $10,000. Directors: W. I. Sockett, of Buffalo, and G. P. Zurbrick and W. DeC. Moore, of Lancaster.

ALBANY, N. Y.—The Interlake Telephone Company has been incorporated to operate in counties in western New York, capital $100,000. Directors: George S. Fuller, Albrecht Vogt and Jacob Gerling, Rochester.

WILLISTON, N. D.—The Williston Telephone Exchange, which was recently incorporated, will build lines to White Earth, N. D., and Culbertson, Mont.

FARGO, N. D.—The Twin City Telephone Company has applied for a franchise in this city to connect Fargo with the Twin Cities by long distance toll lines.

GROVE HILL, OHIO.—The village council has granted a franchise to R. E. Kingery for a telephone system in the village.

ASHTABULA, OHIO.—The new exchange of the Ashtabula Telephone Company, it is expected, will be in operation by November 15. A 1000-drop board is being installed.

ZANESVILLE, OHIO.—The Zanesville council is considering a measure requiring all telephone, telegraph and electric light wires to be placed in underground conduits, within certain limits in this city.

WOODSFIELD, OHIO.—The Woodsfield Telephone Company has elected L. E. Steyne, of Lewisville, secretary and general manager. Z. B. Rhodes, of Zanesville, has been chosen president and treasurer. The company will make a number of improvements to its system.

ZANESVILLE, OHIO.—The Central Union Telephone Company has adopted a new method of fighting the independent company at this point. Bell telephones are to be installed free of charge for a limited time in residences and places of business where the independent telephones are in use.

WARREN, OHIO.—The Madison Telephone Company, at its annual meeting in Warren, elected the following officers: President, C. W. DeVoe, Orwell; vice-president, Dr. H. M. Fenton, Cleveland; secretary, N. R. Williams, Orangeville; treasurer, E. U. Hyde, Orangeville; general manager, E. E. Howes, Mesopotamia. The other director is Dr. C. S. Fenton, Orangeville.

MARION, OHIO.—The Marion County Telephone Company has increased its capital stock to $250,000 to provide for numerous extensions. Exchanges will be established in Prospect, La Rue, Caledonia, Green Camp and other towns. Farmers' lines will be built throughout a large district. The company will give long distance service over the lines of the United States Telephone Company and the connecting line is now being built.

HAMILTON, OHIO.—At the recent annual meeting of the stockholders of the Hamilton Telephone Company, the following officers and directors were elected: F. M. Hughes, president; C. E. Greismer, vice-president; J. W. Slonecker, secretary; F. W. Whitaker, treasurer. Directors: O. M. Blake, S. W. Fitton, J. C. Slayback, E. E. Newman, W. W. Morrison, J. I. Greismer, Ben Strauss and J. Gardner. Rapid progress is now being made in the construction of the system. A switchboard of 2,000 lines capacity is being installed.

CLEVELAND, OHIO.—The annual meeting of stockholders of the Federal Telephone Company, which was set for Oct. 2, was postponed to Nov. 2, owing to the fact that there was no important business to transact at this time. It is announced that E. L. Barber and associates have not yet closed for the purchase of the controlling interest in the United States Telephone Company although developments are expected in the near future. Owing to the fact that its other properties are doing an excellent business, it is stated that the Everett-Moore syndicate is not particularly anxious that the sale of the U. S. Telephone stock be closed up.

WAVERLY, TENN.—A telephone line from this place to Danville will be built in the near future. Dr. M. R. Horner and C. M. Cooly, of Clydeton, and others have the matter in hand.

WEST NEWBURY, VT.— A telephone line is being constructed between West Newbury and the Center.

MILWAUKEE, WIS.—The Richfield, Menomonee Falls and Holy Hill Telephone Company, with the principal office in Richfield, Washington County, has been incorporated to build a telephone line from the village of Richfield by way of Goldenthal to Menomonee Falls, and from Richfield to Holy Hill by way of St. Hubertus, with a branch line to the town of Richfield; capital stock, $1,000. Incorporators: Henry H. Zaun, Hulda Zaun and Bertha M. Zaun.

MILWAUKEE, WIS.—The lines of the American Telephone and Telegraph Company from Milwaukee, for which a franchise was granted some time ago, will soon be completed into Janesville.

ELECTRIC LIGHT AND POWER.

SANTA BARBARA, CALIF.—A franchise for the operation of an electric lighting and power system has been granted to W. W. Barnes, J. T. Coffman and other capitalists who reside in Sonoma County. The corporation will establish generating plants in Santa Maria and Lompoc, from which electric energy for power and light will be transmitted to the ranches intervening.

CARROLLTON, ILL.—The Carrollton Electric Light and Power Company has announced an increase of rates. An explanatory letter states that on account of greatly increased cost of operating, the company finds it necessary to equalize the rates by raising the charge to those who had heretofore been favored by a specially low rate.

BLUFFTON, IND.—A petition for an electric light franchise by a company of local citizens is being held up by the council on the ground that a majority of the councilmen favor municipal ownership of such a plant. The city is $15,000 above the debt limit and it is not likely that it can purchase a plant for the next ten years. The business men urge the granting of the franchise, but the councilmen think some way can be devised to secure the plant for the city.

SAULT STE. MARIE, MICH.—The Hatch Electric Smelting and Refining Company proposes to erect an experimental station here, and power will be furnished by the power company.

ST. LOUIS, MO.—The two bills providing for the construction of electric lighting plants at the City Hall and Insane Asylum, which were introduced a month and a half ago at the request of the Board of Public Improvements, were passed September 30 by the House of Delegates by a solid vote. It is estimated that the establishment of plants in these two institutions will result in a saving to the city of about $15,000 annually. The plant at the City Hall is to cost $33,000 and the one at the Insane Asylum $12,000.

CAPE MAY, N. J.—The new owners of the Cape May Electric Company's plant and light privileges here have re-organized the company under the name of the Cape May Electric Light Company, and have capitalized their corporation at $100,000. The officers are: President, Frank K. Bull, of Racine, Wis.; vice-president, Edward C. Brainard, of Chicago; secretary and treasurer, Edward E. Mandeville, of Chicago, and local superintendent, James W. Hildreth, a lawyer of this city. A new plant will be built. Henry D. Dagitt, the architect and engineer of Philadelphia, completed the plans for the improvement, and the contracts have been let. The power house is to be 68 by 150 feet. The boiler house will be 66 feet by 58 feet, and will contain eight 200-hp watertube boilers. The engine room will contain six 250-hp engines, to be connected direct to 225-kw Western Electric generators. The capacity of the plant will be 10,000 16-cp incandescent lamps, and 200 arc lights of 2,500-cp each. All the poles and lights in the city are to be renewed.

MT. GILEAD, OHIO.—A new electric light and power plant is being built in this town by local parties.

GRAND RAPIDS, OHIO.—The village has placed a contract with A. Pilliod to furnish lights for the town.

BELLAIRE, OHIO.—Prominent citizens of this town are agitating the matter of building a municipal lighting plant.

FOREST, OHIO.—C. C. Hale has been given assurance of a local franchise for an electric lighting plant and hot water heating system.

DELAWARE, OHIO.—The Delaware Electric Light Company is extending its system to cover practically the entire residence section of the city.

WARREN, OHIO.—The county infirmary directors have placed a contract with the Warren Electric Light & Power Company for lighting the infirmary buildings.

THE ELECTRIC RAILWAY.

WASHINGTON, D. C.—The Washington Electric Railway Company will build an addition, 30x250 feet, to its power house. New equipment will be installed.

DETROIT, MICH.—It is reported that the Pullman Car Company has sold its old plant in this city to the Detroit United Railway for $70,000, and that the latter company will construct its own rolling sock.

SPRINGFIELD, OHIO.—Directors of the Dayton, Springfield & Urbana Railway will meet Oct. 15 to consider the advisability of increasing the capital stock of the company to $1,500,000.

ALLIANCE, OHIO.—The Akron-Alliance Connecting Railway has been granted a franchise enabling it to reach the center of Alliance. The company will give a three cent fare inside the city limits.

COLUMBUS, OHIO.—The Greenville & Union City Traction Company, of Greenville, capital stock $75,000, has been incorporated by J. E. Lowes, J. E. Feight, T. J. Weakley, W. B. Gebhart and Ralph E. Deweese, of Dayton. The same parties are interested in the Dayton & Northern Traction Company and the new line will be an extension of the latter road.

SPRINGFIELD, OHIO.—At the recent annual meeting of the Springfield Railway Company, officers and directors were elected as follows. Directors: O. T. Martin, J. H. Miller, W. F. Foose, Charles L. Bauer and Theodore Troupe, of Springfield; Samuel DeCoursney, H. J. Crowley, J. J. Sullivan and W. H. Shelmerdine, of Philadelphia. O. T. Martin is president; H. J. Crowley, vice-president; L. C. S. Tingley, secretary-treasurer, and J. H. Miller, general manager. The property is controlled by the American Railways Company, of Philadelphia.

COLUMBUS, OHIO.—The roads centering in Columbus controlled by the allied interests of Tucker, Anthony & Co., and A. E. Appleyard, of Boston, have placed on sale at their various offices, 500 and 1,000-mile mileage-books, good on any of the roads of the system. The books are sold at the rate of 1¼ cents per mile and can be used on the following roads: Columbus, Buckeye Lake & Newark Traction Co., Columbus, London & Springfield, Dayton, Springfield & Urbana, Columbus, Grove City & Southwestern, Springfield & Western, and Cincinnati, Lebanon & Dayton.

LEGAL.

U. S. INCANDESCENT LAMP CO.—Suits were filed in the Circuit Court September 30 by H. G. Ferguson, in which he asks for the appointment of a receiver for the United States Incandescent Lamp Company, St. Louis. Ferguson charges that on May 1, 1898, he and J. M. Davey entered into partnership, it being agreed that he would furnish the money and Davey attend to the business and share one-half the profits. On August 21 Davey filed suit against Ferguson, asking for an accounting of the business. Ferguson now claims the firm owes him $34,628.50. He fixes the assets of the firm at $23,000, and its liabilities $35,000. He claims he is under contract to furnish lamps to the city and asks for the appointment of a receiver to take charge and conduct the business of the firm.

CHICAGO TELEPHONE RATES.—At Chicago, on October 6, Judge Tuley gave the complainants in the suit of the Illinois Manufacturers' Association permission to amend their petition for injunction so as to enable them to secure the return of the funds alleged to have been collected in excess of the franchise rate. The construction placed on his decision by attorneys for the complainants is that 5,000 or 6,000 telephone lessees may come into the suit and become parties to it, whether they are members of the Manufacturers' Association or not. The decision of the court, it is estimated, will cost the Chicago Telephone Company more than $1,000,000, unless the Supreme Court reverses the judgment of Judge Tuley. All that remains for the complainants to do now is to prove up their claims. There were 337 lessees involved in the original suit, their claims being in the aggregate about $75,000, but all the druggists, liverymen, and private citizens who paid $175 a year for their telephones may come in and become parties to the suit, Judge Tuley holding that all may be considered together. The question as to whether they can go back of five years, the time provided in the statute of limitation, remains to be argued.

NEW INDUSTRIAL COMPANIES.

THE IDAHO SPRINGS ELECTRIC CHLORINATION COMPANY, of Saco, Me., has been incorporated with a capital of $500,000. P. C. Tapley is president and J. R. Powers, treasurer.

THE M. B. FOSTER ELECTRIC COMPANY, of New York, has been incorporated; capital, $1,000. Directors: M. B. Foster, New York; T. F. Freund, Bayonne, N. J.; F. H. Corduan, Brooklyn.

THE LOCKE INSULATOR MANUFACTURING COMPANY, of Victor, N. Y., has been incorporated, capital $150,000. Directors: F. M. Locke, Victor; C. P. Brown, Shortsville; H. M. Parmele, East Bloomfield.

THE CHICAGO TELEPHONE SUPPLY COMPANY, with a capital stock of $500,000, of which $50,000 is represented in Indiana, has complied with the law by filing articles of incorporation with the Secretary of State. Henry L. Briggs, of Elkhart, is named as the company's State agent.

THE CLEVELAND AUTOMATIC MACHINE COMPANY, of Cleveland, Ohio, has been incorporated under the laws of New Jersey, with $1,500,000 capital stock, by George H. Kelly, G. G. Whitcomb, J. C. Russell and A. L. Garford, of Cleveland. The company succeeds the Cleveland Machine Screw Company.

THE CHAPMAN FUEL ECONOMIZING SYSTEM, of Albany, N. Y., was incorporated recently, with a capital of $35,000, to manufacture a certain invention of John S. Chapman, to be used for economizing in the use of fuel, arresting smoke and increasing steam boiler capacity. The directors are John S. Chapman, Isaac La Grange, James W. Bentley and B. A. Chapman, of Albany; John Pressley, M. Pressley and M. Weighill, of Rochester.

THE COLONIAL SIGN COMPANY, capitalized at $25,000, has been reorganized at Akron, Ohio, with H. B. Camp, president; George P. Good, vice-president; C. R. Quine, secretary; J. E. Good, treasurer, and G. D. Chapman, general manager. The company will erect a factory at Barberton for the manufacture of porcelain letter electric signs of which Messrs. Quine and Chapman are inventors and patentees. The office of the company will be located in Akron.

PERSONAL.

MR. W. E. HASELTINE, of the Holtzer Cabot Company, Brookline, Mass., was a recent visitor to New York City.

MR. MAURICE A. OUDIN, of the General Electric Company, has returned to Schenectady from a recent visit to Europe.

MR. G. D. PITMAN, of Sibley & Pitman, electrical manufacturers and contractors of New York City, has just returned home from a European trip.

MR. J. A. McELROY, of the British Electrical engineering and contracting firm of Macartney, McElroy & Company, is now on a short visit to the United States.

MR. GUISEPPE MUSSO, an official under the Italian government, is in the United States with regard to the development of a wireless telegraph application he has devised.

MR. G. MARTIN BRILL, of the Brill Car Company, is reported among prominent Philadelphians interested in the consolidation of the railroads of Yucatan, Central America.

MR. FRANK MAC GOVERN, of Rossiter, MacGovern Company, has just returned home in time to attend the street railway convention at Detroit, after a trip to the other side of the Atlantic.

MR. J. J. HENRY, of Denver, Col., owner of ten or more gas and electric light properties in the Far West, spent a week in Chicago recently accompanied by his consulting engineer, Mr. Thomas B. Whitted.

MR. H. BEVIS, of the General Electric Company, 1900 Ltd., of London, England, is expected to arrive in the United States about October 15, and will make his headquarters at the Hotel Imperial, New York City, as usual.

MR. H. F. PARSHALL, the American consulting engineer, who has so long made London his headquarters, has been in this country, but sailed during the week for England, where some important electrical problems await his attention.

MAJOR S. FLOOD PAGE, M. I. E. E., managing director of the Marconi Wireless Telegraph Company, Ltd., and of the Marconi International Marine Communication Company, Ltd., was among the arrivals on the Cunarder "Campania" last Saturday.

MR. HERBERT LAWS WEBB, of the New York Telephone Company, sailed for England last week, on a combined business and pleasure trip that may last some months. Mr. Webb is well acquainted all over Europe and is a nephew of Sir W. H. Preece, K. C. B.

MR. ELGIN E. STODDARD, head salesman with Charles C. Moore & Company, representing the Babcock & Wilcox Water Tube Boiler Company and the McIntosh & Seymour Engine Company in San Francisco, has been visiting to New York and the Eastern States on business.

MR. JOHN L. PUTNAM, manager of the Clark Automatic Telephone Switchboard Company, Providence, R. I., was a visitor at the New York office of ELECTRICAL WORLD AND ENGINEER last week, on his way West, where he is making an extended tour in the interests of his company.

MR. W. N. CUMMINGS, who was formerly connected with the American Vitrified Conduit Company, and was latterly manager of the British Electrical engineering and contracting firm of Maguire & Baucus, of London, is at present on a visit to this side. He is a guest at the Hotel Imperial.

DR. M. I. PUPIN returned recently from a trip to England and the Continent and resumes his duties at Columbia University, New York. He was called abroad in relation to his various important inventions in the field of telegraphy and telephony. Among the countries visited were Germany and Austria.

MR. A. B. SANDERS, who has for several years been connected with the engineering department of the American Telephone & Telegraph Company at New York, has resigned to take a position as sales engineer with the Electric Storage Battery Company, of Philadelphia. Mr. Sanders assumed his new duties on Oct. 6.

MR. CHARLES S. DRUMMOND, the president of the Manhattan Transit Company and one of the principal directors of the British Electric Traction Company, Limited, who has been on this side for some weeks past regarding the business of the former concern, sailed Tuesday for Europe by the North German Lloyd liner Kaiser Wilhelm der Grosse.

MR. G. MARCONI.—A cable dispatch from Rome, Italy, of October 4, says: Mr. Marconi announces that he has perfected an electric motor-car having a speed of thirty-eight miles an hour, the accumulators weighing 250 pounds, being sufficient for a journey of 560 miles. There are four batteries arranged in a circle divided into four sections. Tests will be made soon in Paris.

MR. C. H. NORWOOD, formerly representative of the Cutler-Hammer Mfg. Co. in Chicago, has been appointed to the care of the Chicago office of the Commercial Electric Company, of Indianapolis. He will be located at 1503 Fisher Building, and will devote his attention to the application of direct current electrical machinery for the economical distribution of light and power.

MR. RALPH W. POPE, secretary of the American Institute of Electrical Engineers, was married to Mrs. Katherine A. Durant, of Great Barrington, Mass., on Wednesday afternoon, October 1, at the bride's summer cottage, Ocean Grove, N. J. The ceremony was performed by the Rev. Mr. Longley, rector of Trinity Church, Asbury Park. Mr. Pope is well known as a veteran electrician, and has been secretary of the Institute for some sixteen years.

MR. A. C. SHAW, European manager for the ELECTRICAL WORLD AND ENGINEER and representative there also of the other McGraw Publishing Company's interests, arrived in this country last week per "Campania," to attend the street railway convention at Detroit. Mr. Shaw has a host of friends and acquaintances in America, where he spent a great many years. He is very much interested in recent developments here, and has much to say of the rapid electrical progress abroad.

MR. ADOLF ASCHOFF, of the electrical engineering and contracting firm of James Mitchell & Company, of Rio Janeiro, which concern represents the Brazilian interests of the General Electric Company, McIntosh, Seymour & Company and other prominent American manufacturers, has been on a visit to the United States for the last two months or so. He sailed Tuesday for Europe on the North German Lloyd liner Kaiser Wilhelm der Grosse with his wife and daughter. After remaining a few days on the other side, Mr. Aschoff will take a direct steamer to Brazil.

MR. J. H. SWINNARTON, who has been vice-president and general manager of the Staten Island Electric Railroad Company since its organization, some four years ago, has turned over the management of the company to S. F. Hazelrigg. Mr. Swinnarton had been asked to remain by the new Richmond Light and Railroad Company, which succeeds the old company, but did not see his way clear to do so. Mr. Swinnarton's resignation is greatly regretted by the employees of the road, as he was well liked by the men. He intends to sail for Europe on the first of November.

WILBUR M. ERBIN, Ph. D., of Philadelphia, was elected recently to the chair of philosophy in Trinity College. He at present holds the same position in Ursinus College, Philadelphia, and takes up his duties at Trinity this fall. The chair of physics will be occupied next year by Henry A. Perkins, of Hartford. Mr. Perkins is a graduate of Yale, in the class of 1896. He spent three years at the School of Mines, Columbia University, and has received the degrees of E. E. and M. A. from that institution. He was at one time connected with the Hartford Electric Light Company. He has been the past year at Yale, where he holds a scholarship.

MR. THOMAS B. WHITTED has opened an office as consulting engineer at 221-224 Equitable Building, Denver, Col. Mr. Whitted has for several years been district engineer of the General Electric Company at the Denver office and is consequently exceptionally well versed in electrical engineering practice in the mountain regions. He has been retained regularly to look after the J. J. Henry properties which include the Tucson (Ariz) Gas, Electric Light and Power Company; Albuquerque, (N. Mex.,) Gas, Electric Light and Power Company; Rawlins (Wyo.) Electric Light and Fuel Company; Sheridan (Wyo.) Electric Company; Baker Gas and Electric Company, and a number of others.

NEW INSTITUTE MEMBERS.—At the last meeting of the Board of Directors in the afternoon the following named Associates were elected: Armstrong, James Roberts Charlton, 140 E. 34th St., New York City. Baylis, James Adams, electrical engineer, The Bell Telephone Co., Montreal, P. Q. Beldon, David W., electrical engineer and general superintendent, The Phœnix Light and Fuel Co., Phœnix, Ariz. Benecke, Adelbert O., Weston Electrical Instrument Co., Waverly Park, Newark, N. J. Burson, Herbert Arthur, demonstrator in electrical engineering, McGill University, Montreal, P. Q. Cogan, Henry Manning, electrical engineer, The American Sugar Refining Co. of New York, Kent Ave and So. 4th St., Brooklyn, N. Y. Dillon, Edward Paul, assistant superintendent, Colorado Department, Telluride Power Co., Telluride, Col. Finney, John H., assistant manager, New York office, Stanley Electric Mfg. Co., 29 Broadway, New York City. Freund, Henry Paul, testing department, General Electric Co., Schenectady, N. Y. Gibbs, Harry Parker, constructing engineer, Gen. Elec. Co., Champion Reef, Kolan Gold Field, South India. Hartmann, Francis M., instructor of experimental physics and electrical measurements, Cooper Union, New York City. Hatch, Austin Smith, assistant general superintendent, Public Lighting Commission, 40 East Atwater St., Detroit, Mich. Hill, Joseph Mansfield, Edison Storage Battery Co., Orange, N. J. Hodgson, Cecil, electrical engineer with Stephens & Tyler, 709 Monadnock Block, Chicago. Holley, Carl Hiram, chief engineer. The Mt. Whitney Power Co., Visalia, Cal. Hudson, Harry Pratt, Inspector U. S. Engineer's Office, 5 Masonic St., New London, Conn. Hunter, Madone C., electrical engineer, Kilbourne and Jacobs Co., Columbus, Ohio. Joyner, Albert Henry Winter, electrical engineer, Edison Electric Illuminating Co., of Boston, Mass. King, R. O., 503 Markham St., Toronto, Ont. Leslie, Hugh, engineer, The Electric Storage Battery Co., 19th St. and Allegheny Ave., Philadelphia, Pa. Lusk, William Clardy, agent, General Electric Co., residence, 234 Union St., Schenectady, N. Y. McIntyre, Henry Knox, assistant engineering department, New York Telephone Co., 15 Dey St., New York City. Myers, Frederic William, superintendent of construction, Standard Underground Cable Co., Pittsburg, Pa. Packard, Granville Frederick, chief engineer, Stow Manufacturing Co., 195 Court St., Binghamton, N. Y. Parodi, Hippolyte, electrical engineer Francaise Thomson-Houston Cie, 10 Rue de Londres, Paris, France. Pearson, John, superintendent St. Croix Power Co., Somerset, Wis. Potter, Carroll, superintendent, Electric Storage Battery Co., 19th St. and Allegheny Ave, Philadelphia, Pa. Potts, Louis Maxwell, chief constructing engineer, Rowland Telegraphic Co., 710 No. Howard St., Baltimore, Md. Robinson, John Knowlton, agent, West Coast of South America, Westinghouse Elec. and Mfg. Co., Iquique, Chili, S. A. Rowland, Herbert Raymond, electrical draughtsman, Pennsylvania Steel Co., 17 N. 4th St., Steelton, Pa. Spengel, Hermann Georg, general manager, Rand Central Electric Works, Ltd., Box 3498, Johannesburg, S. A. Steinmetz, Edward George, assistant superintendent, The Electric Storage Battery Co., 19th St. and Allegheny Ave., Philadelphia, Pa. Tuttle, Horace Burt, engineering chemist, Cleveland Electrical Illuminating Co., 727 Cuyahoga Building, Cleveland, Ohio. Vom Baur, Carl Hans, electrical engineer, American Union Electric Co., 18 West 130th St., New York City. Wilson, Leonard, electrical engineer, Stanley Electric Mfg. Co., Pittsfield, Mass. Woodward, Cornelius Wendell, purchasing agent, The Electric Storage Battery Co., 19th St. and Allegheny Ave., Philadelphia, Pa. Young, John Mason, student in electrical engineering, Cornell University; residence, 302 Eddy St., Ithaca, N. Y. The following Associates were transferred to Membership: Thomas E. Murray, second vice-president and general manager, New York Edison Co., New York City. W. S. Franklin, professor of physics and electrical engineering, Lehigh University, South Bethlehem, Pa. Bernhard A. Behrend, in charge alternating department, Bullock Electric Mfg. Co., Norwood, Ohio. D. L. Huntington, general manager and chief engineer, Washington Power Co., Spokane, Wash.

Trade Notes.

THE W. D. GRAVES ELECTRIC & MACHINE WORKS, heretofore of Cleveland, have removed to Wheeling, W. Va., and have been incorporated as the Mutual Electric & Machine Company.

TO ENLARGE PLANT.—The Union Electric Company, of Cazenovia, N. Y., has sold its entire plant to the Cazenovia Electric Company. The plant will be rebuilt and enlarged as soon as possible. Mr. J. H. Ten Eyck Burr is the manager of the new company.

DAVENPORT MACHINE WORKS.—The W. W. Whitehead Company, Davenport, Ia., has changed its name to the Davenport Machine Works, and disposed of its second-hand machinery business. The company is prepared to execute orders for light locomotives and heavy machinery of all sorts.

WIRELESS CLUSTERS.—The Benjamin Electric Mfg. Co., 1992 West Van Buren Street, Chicago, Ill., has issued a catalogue of its Benjamin Wireless clusters and electrical specialties. These clusters are made in various styles and include ceiling forms, pendant forms, weather-proof forms, and car clusters.

BELT CONVEYORS.—Ridgway's patent belt conveyor system, manufactured by the John A. Mead Mfg. Co., 11 Broadway, New York, is very completely described and illustrated in a neat pamphlet just issued by this company. The essential features of this system are new and interesting besides being a practical improvement.

THE NORTH ELECTRIC COMPANY, Cleveland, Ohio, is removing its factory and general offices into a large five story building on St. Clair Street, in that city. The building has been entirely remodeled for manufacturing purposes and the North Company will occupy practically the whole of it, giving it several times the floor space of the old factory.

GREGORY INSTALLATIONS.—It requires most of 70 octavo pages of type to record the installations up to date of the Gregory Electric Company, of Chicago. This record is bound in pamphlet form with an attractive cover. Some illustrations show the offices and various departments of the company's large factory. The record is one of which the company may well be proud.

DIRECT-CURRENT DYNAMOS AND MOTORS.—The Star Dynamo Works, Jefferson City, Mo., manufactures a line of dynamos and motors ranging from ¾ to 3 kw and 1 to 4 hp. These are illustrated and described in a pamphlet recently issued by the company. This concern makes a specialty of complete outfits for incandescent and arc lighting of 15, 25 and 50-light capacity.

THE SAN FRANCISCO ELECTRIC PROTECTIVE COMPANY, which has filed articles of incorporation with a capital stock of $100,000, will install a second burglar alarm system in San Francisco. The stockholders of the company are Ex-Captain of Detectives John Seymour, Ex-Lieutenant of Police Fred Esola, J. L. Eppinger, Henry Rosenfeldt and Harry Goodall. The company will open for business as soon as the necessary plant can be purchased and installed.

ROBIN'S BELT CONVEYORS.—The adaptability of the Robin's belt conveyor for the handling of material which attacks iron, such as salt, etc., is well illustrated in a large illustrated circular just issued by the company. One illustration shows a conveyor handling salt, another shows a Robin's conveyor in the works of the Acker Process Company at Niagara Falls. This conveyor is particularly well adapted for use in chemical works. The working parts are protected against contact with corrosive substances, the conveyor being a rubber belt with its edges turned up dish fashion.

POWER PUMPS.—The Gould's Manufacturing Company, of Seneca Falls, N. Y., as is well known is one of the largest manufacturers of power pumping machinery. Its products in this line are very clearly shown in illustration and briefly described in a handsome pamphlet of 160 pages just issued by the company under the title "Efficient Triplex Power Pumps." The catalogue covers the company's entire line of triplex power pumps for every service, pumps suited for each service being grouped in sections. Any one interested may obtain a copy of this complete catalogue by applying to the company.

VENTILATORS.—The Buffalo Forge Company, Buffalo, N. Y., in a pamphlet calls attention to the merits of its "Buffalo Improved Ventilators" which are specially recommended for the rapid and constant withdrawal of impure air, hot air, smoke, steam or gases. The removal is effected by accelerated upward currents of air induced in the ventilator. The exhaust currents, it is stated, are unfailingly set up by wind action, also by the difference of temperature between the inside and outside air. These ventilators are recommended for use in the ventilation of factories, mills, hotels, schools and buildings of all classes.

JAEGER LAMPS.—Dr. C. A. Meeker, the well-known dentist of Newark, N. J., writes to the Jaeger Miniature Lamp Co.: "I bought one of your lamps at the N. J. Exhibit Annual Meeting of 1902. Permit me to say it is the best I have ever been the possessor of. I have purchased many, the earliest in 1883, exhibited at the A. D. A. meeting in Newark. The care of the batteries and the vexatious delays of giving out just when you most desired them, always made them a necessary evil. This one seems to go as long as the street current continues. You should bring it before the profession by advertising it."

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, general selling agent for the new Peerless incandescent lamps, states that owing to the popularity and exceedingly large demand for this lamp, the factory has largely increased its capacity recently, and while it is making even better lamps than ever, on account of the very greatly increased facilities, it is offering this lamp at a slightly lower figure. It states that this lamp is thoroughly high grade, and that it has met with unusual success with it. It is sold subject to the strongest of guarantees. Any one on the market for lamps is requested to communicate with the company.

JOHNSON & MORTON, Utica, N. Y., have just issued a new catalogue on "Panel Boards and Accessories," which is the most convenient and complete literature published on this subject. The catalogue includes all forms of panel and distribution boards and all fittings that are ordinarily used in connection with them. The lists are arranged so as to be very convenient for reference. Each style of panel is listed on a separate page, and all of the items for use in connection with the panels are given on the same page as the panel boards list. This feature will be a great convenience to all of the contractors in estimating, as they can get the complete prices without referring to a number of catalogues. The company has just completed a large addition to its plant, increasing the floor space about four times, and is now equipped to fill promptly all orders for panel boards, distribution boxes, switches and switchboards. The company has decided to discontinue the New York office, and will handle this business directly from the factory in the future.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPTEMBER 30, 1902.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

709,865. RAILWAY SWITCH OPERATING DEVICE; J. C. Booth, Monessen, Pa. App. filed May 14, 1902. By operating a push button on the car, a magnet is energized to throw downward a plow that engages with mechanism in the roadway to move the switch.

709,867. PROCESS OF MANUFACTURING NITROGEN COMPOUNDS FROM ATMOSPHERIC NITROGEN; C. S. Bradley, New York, N. Y., and D. R. Lovejoy, Niagara Falls, N. Y. App. filed March 9, 1900. (See page 579.)

709,868. APPARATUS FOR SUBJECTING CASES TO HIGH TENSION DISCHARGES; C. S. Bradley, New York, N. Y., and D. R. Lovejoy, Niagara Falls, N. Y. App. filed Aug. 29, 1901. (See page 578.)

709,878. MANUFACTURE OF RAIL BONDS; F. H. Daniels and H. W. Wyman, Worcester, Mass. App. filed Feb. 7, 1902. The end of the bond has a socket to receive a plug which spreads the end in the orifice in the rail.

709,915. CONTROL OF ELECTRIC MOTORS; H. W. Leonard, Bronxville, N. Y. App. filed Aug. 26, 1901. (See Current News and Notes.)

709,916. METHOD OF CONTROLLING ELECTRIC MOTORS; H. W. Leonard, Bronxville, N. Y. App. filed Dec. 10, 1901. (See Current News and Notes.)

709,971.—ELECTROLYTIC DECOMPOSITION OF ALKALINE SALTS; E. Edser and M. Wildermann, London, Eng. App. filed March 28, 1902. (See page 578.)

709,982. APPARATUS FOR SEPARATING MAGNETIC AND NON-MAGNETIC MATERIALS FROM ONE ANOTHER; J. W. R. T. Heberle, Sala, Sweden. App. filed Dec. 28, 1897. A vertically moving belt having magnets behind it is arranged in a water tank, the magnetic particles being conveyed thereby to a compartment on one side of a partition, while the other particles fall to the other side.

709,996. SIGNAL LAMP FOR TELEPHONE SWITCHBOARDS; Frank R. McBerty and Frederick H. Loveridge, Evanston, Ill. App. filed May 14, 1900. (Notice will appear in next week's issue.)

710,045. ELECTRICAL STEERING GEAR; M. W. Day, Schenectady, N. Y. App. filed Aug. 23, 1901. (See Current News and Notes.)

710,050. CONSTANT CURRENT TRANSFORMER; A. R. Everest, Lynn, Mass. App. filed March 4, 1899. In order to compensate for the variations of the load curve, a variable counter weight is provided of such nature as to decrease the force urging the coils together the more they are separated.

710,052. APPARATUS FOR MAINTAINING UNIFORM RESISTANCE IN ELECTRIC CIRCUITS; F. A. Gilbert, Brookline, and E. O. Lundin, Beachmont, Mass. App. filed Dec. 17, 1897. An electric arc lamp provided with series and shunt regulating coils, and a controlling magnet in shunt to the arc for cutting out part of one of said coils after a determinate rise of temperature due to starting the lamp, to compensate for change of arc length due to such rise of temperature.

710,055. ELECTRIC ARC LAMP; C. E. Hartban, Lynn, Mass. App. filed July 24, 1900. Means for adjusting the carbon carrying tube within the surrounding spool and coil.

710,056. AUTOMATIC CIRCUIT BREAKER; C. D. Haskins, Schenectady, N. Y. App. filed Dec. 14, 1900. A transformer having its primary coil in circuit with the apparatus to be protected, a fragile conductor in the main circuit and devices controlled by the secondary coil for rupturing the fragile conductor.

710,065. SELF RESTORING TELEPHONE; Louis J. Loeffler, New York, N. Y. App. filed October 23, 1901. (Notice will appear in next week's issue.)

710,067. SYSTEM OF ELECTRICAL DISTRIBUTION; A. D. Lunt, Schenectady, N. Y. App. filed Jan. 31, 1901. Certain means for connecting a neutral conductor through a point of neutral potential to an armature winding of a dynamo electric machine.

710,068. METHOD OF MAINTAINING UNIFORM RESISTANCE IN ARC LAMP CIRCUITS; E. O. Lundin and F. A. Gilbert, Boston, Mass. App. filed Dec. 17, 1897. A method of regulating lamps having series and shunt coils consisting in automatically cutting out part of one coil, when it heats after starting the lamp, to compensate for the change of voltage at the arc accompanying such heating.

710,070. APPARATUS FOR MULTIRATE METERING; E. Oxley, Lynn, Mass. App. filed March 8, 1899. A number of meters located at the various points of consumption, each being arranged to register at more than one rate and an automatic control device operated by current received from the system for changing the rate at which the meters register.

710,072. ELECTRIC RAILWAY SYSTEM; W. B. Potter, Schenectady, N. Y. App. filed Feb. 28, 1901. The conveyor of a sand box is run by an electric motor when desired.

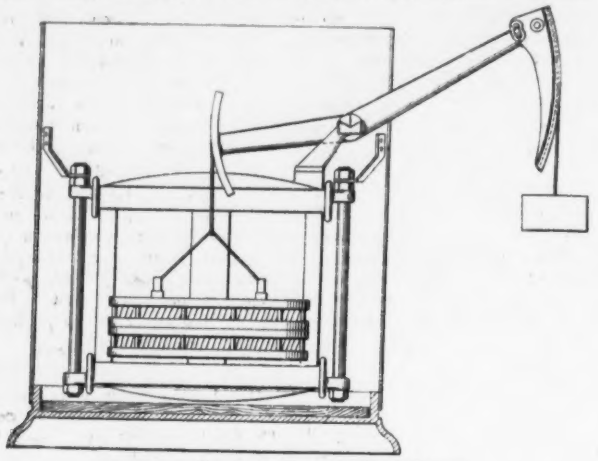
710,081-82. SYSTEM OF ELECTRICAL DISTRIBUTION; Charles P. Steinmetz and William L. R. Emmet, Schenectady, N. Y. App. filed Dec. 21, 1899. By means of a phasing transformer, two phase e.m.fs. are derived from a three-phase circuit and combined to produce six-phase e.m.fs., the latter being supplied to a rotary converter. Means are also provided for leading out from the phasing transformers a neutral to form part of the direct-current circuit.

710,083. ELECTRIC METER; G. Stern, Charlottenburg, Germany. App. filed Dec. 11, 1900. In this meter a shunt circuit is so organized that the current therein is displaced by 90° behind its electro-motive force, so as to reduce the consumption of energy in the shunt circuit.

710,084. CLOCK CHIME; G. M. Stevens, Cambridge, Mass. App. filed July 22, 1901. Details.

710,096. ELECTRIC CONTROLLER; W. A. Carrell, West Homestead, Pa. App. filed June 21, 1901. A regulator having in combination a series of contact plates connected to resistances, a head carrying contacts so arranged with reference to the contact plates as to maintain a closed circuit at all times and a circuit changer provided with a magnetic blow-out.

710,099. METHOD OF EXHAUSTING INCANDESCENT ELECTRIC LAMPS OF RELATIVELY LOW VOLTAGE; S. E. Doane, Marlboro, Mass. App. filed Feb. 7, 1902. In order to properly heat the joints of the



710,050.—Constant Current Transformer.

leading-in wires, during exhaustion of low potential lamps, two currents are used, one of low potential through the filament, and the other of high potential through the gases in the bulb.

710,121. WIRELESS TELEGRAPH SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Dec. 11, 1901. A transmitter for wireless telegraphy, which comprises means for generating high-frequency oscillations, and connections from said generator to the terminals of a winding, a portion of said winding operating as the inductance element of a resonant radiating circuit.

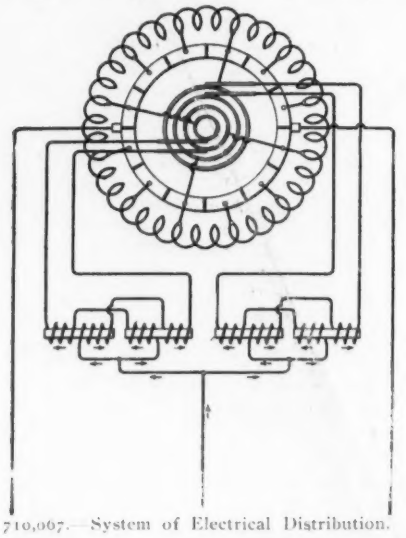
710,122. WIRELESS TELEGRAPH SYSTEM; H. Shoemaker, Philadelphia, Pa. App. filed Jan. 11, 1902. Improvements in various features of the system, including an adjustment for the tapper and a shield for the wave-responsive device when in operation.

710,143. RESISTANCE COIL AND SUPPORT THEREFOR; H. P. Davis, Pittsburg, Pa. App. filed Dec. 26, 1901. A resistance element comprising two rings of different diameters projecting in opposite directions from an open-work frame, a spiral coil of resistance material surrounding the smaller ring and a number of insulating blocks mounted in the frame at one side of the coil.

710,146. AUTOMATIC ELECTRIC TIME SWITCH; H. K. Gardner, Providence, R. I. App. filed Feb. 5, 1902. Details.

710,158. SYSTEM OF ELECTRICAL DISTRIBUTION; B. G. Lamme, Pittsburg, Pa. App. filed Oct. 14, 1901. (See Current News and Notes.)

710,186. METHOD OF EXHAUSTING INCANDESCENT ELECTRIC LAMPS; S. E. Doane, Marlboro, Mass. App. filed Dec. 10, 1900. A method of exhausting lamps of different voltage simultaneously, consisting in first producing the vacuum and admitting the vapor or gas through a



710,067.—System of Electrical Distribution.

common tube and then passing a current of high voltage through one lamp and a current of low voltage through the other.

710,188. ELECTRIC SWITCH; B. J. Foley, Pittsburg, Pa. App. filed Sept. 22, 1900. Details.

710,201. MEANS FOR PREVENTING INJURY IN USING X-RAYS; L. T. Lowder, Bloomington, Ind. App. filed Nov. 23, 1901. A laminated armor of material proof against the penetration of X-rays.

710,206. APPARATUS FOR TRANSPOSING ELECTRIC CIRCUIT WIRES SO AS TO EQUALIZE INDUCTION; J. O'Brien and J. Mattimore, Staten Island, N. Y. App. filed Aug. 12, 1901. Frames are applied at intervals to the parallel conductors, within which the conductors are crossed.

710,216. INSULATING HANGER; J. M. Schmidt, Elkhorn, W. Va. App. filed June 12, 1902. Details.

710,270. ELECTRIC SWITCH; F. H. Headley, St. Austell, England. App. filed Jan. 21, 1901. Details.

710,278. ELECTRIC BATTERY; T. H. Klinker, Jr., and R. Gareillsky, Jersey City, N. J. App. filed April 5, 1902. The two elements of a sealed cell are provided with tubular passages through which liquid can be introduced to the cell when it becomes exhausted.

710,282. INSULATOR; E. Lefever, Climax, Ohio. App. filed March 29, 1902. The insulating block is covered with sheet metal having upwardly projecting wings which bend in opposite directions over the wire for attachment.

710,297. INSULATOR; R. S. Peirce, Chicago, Ill. App. filed Feb. 10, 1902. The threaded pin is in two loose parts, placed on opposite sides of a flat plate, which projects beyond the upper end of the pin. When the knob screws on, it strikes the end of the plate and draws the two parts of the pin into intimate contact with itself.

710,309. TELEPHONE TRANSMITTER; Mathias Weisser, of Milwaukee, Wis. App. filed January 11, 1902. (Notice will appear in next week's issue.)

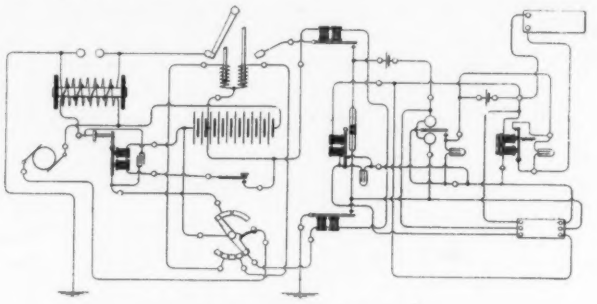
710,311. ELECTROMAGNETIC DEVICE FOR CONTROLLING THE ROTATION OF SHAFTS; P. V. Avril, Paris, France. App. filed April 20, 1901. Details.

710,318. TOLL APPARATUS FOR TELEPHONE EXCHANGES; William W. Dean, Chicago, Ill. App. filed January 14, 1902. (Notice will appear in next week's issue.)

710,320. SIGNALING APPARATUS; H. A. Fessenden, Detroit, Mich. App. filed Sept. 6, 1901. The arm of the sending apparatus is followed in its movements by an index and the failure of the index to move, shows that the signal was not received.

710,333. SELECTIVE CALLING APPLIANCE FOR TELEPHONE LINES; Frank R. McBerty, Evanston, Ill. App. filed May 21, 1898. (Notice will appear in next week's issue.)

710,335. SELECTIVE CALL FOR TELEGRAPH OR TELEPHONE LINES; William Palmer, Jr., Rincon, N. M. App. filed December 11, 1901. (Notice will appear in next week's issue.)



710,122.—Wireless Telegraph System.

710,346. ELECTROMETALLURGIC TREATMENT OF ORES OF COPPER OR OTHER METALS; C. J. Tossizza, Paris, France. App. filed Aug. 6, 1901. (See Current News and Notes.)

710,348. ELECTRICAL SYSTEM OF RECORDING AND CHECKING AS APPLIED TO RAILWAY SIGNALING; W. H. M. Weaver, Macon, Ga. App. filed June 1, 1901. Details.

710,354. WIRELESS TELEGRAPH SYSTEM; C. D. Ehret, Washington, D. C. App. filed Dec. 3, 1901. The waves are received upon an aerial circuit resonant with the transmitted waves and a wave-responsive device is subjected to the excessive potential difference at the terminals of a frequency-determining element of the resonant circuit.

710,355. WIRELESS TELEGRAPH SYSTEM; C. D. Ehret, Rosemont, Pa. App. filed Dec. 3, 1901. Apparatus for carrying out the preceding method.

710,356. CIRCUIT BREAKER FOR ELECTRIC LAMP GLOWERS; F. M. Goddard, Pittsburg, Pa. App. filed July 20, 1899. The automatic cut-out devices for the heater are substituted by hand cut-outs, for cheapness, where conditions permit.

710,363. METHOD OF STARTING ROTARY CONVERTERS; B. G. Lamme, Pittsburg, Pa. App. filed Feb. 1, 1902. (See Current News and Notes.)

710,367. CIRCUIT BREAKER; C. J. Reed, Philadelphia, Pa. App. filed Feb. 19, 1899. A storage battery is in shunt around the contact, and when the latter are separated, the battery is thrown into circuit with the protected dynamo, is rapidly charged thereby and opposes its electro-motive force to that of the dynamo.

710,369. ELECTRIC LAMP GLOWER AND METHOD OF ATTACHING TERMINAL WIRES THERETO; E. R. Roberts, Bellevue, Pa. App. filed April 10, 1902. The terminal wires are temporarily pasted to the ends of the glower for handling purposes, and then permanently secured thereto by applying a globule of cement.

710,372. DECOHERER; H. Shoemaker, Philadelphia, Pa. App. filed Jan. 11, 1902. A construction whereby the mechanical shock given to a coherer tube may be carefully regulated and nicely adjusted during the operation of the receiver.

710,373. INTERRUPTER FOR ELECTRIC APPARATUS; H. Shoemaker, Philadelphia, Pa. App. filed Jan. 11, 1902. A motor driven, reciprocating contact into the path of travel of which is brought a second contact under the control of a telegraph key.

710,374. ELECTRIC ARC LAMP; A. F. Shore, New York, N. Y. App. filed Nov. 9, 1899. Improvements in a lamp using ring-shaped carbons.

Twenty-first Annual Meeting of the American Street Railway Association.

THE twenty-first annual convention of the American Street Railway Association began at Detroit, Mich. on October 8, in the Light Guard Armory, where also the exhibit of apparatus was made. The convention was, as usual, remarkably well attended, and when President Vreeland called the meeting to order at 11 A. M., several hundred delegates and visitors were present to participate in the opening exercises. An admirable address of welcome was delivered by Mayor Maybury, and Mr. Vreeland then delivered one of the best presidential addresses ever heard by the Association. It was received with marked warmth of approval.

PRESIDENT VREELAND'S ADDRESS.

In his opening remarks, President Vreeland referred to the appropriateness of holding the twenty-first annual meeting of the American Street Railway Association in Detroit, for, while the city street railways of the country have not been idle during the last year, the greatest development in electric railway work since the last convention, and, in fact, for several years has been in the direction of interurban electric railways, and in this class of road Detroit railway enterprise has always been prominently identified, the city ranking with Cleveland, Indianapolis, Cincinnati and Dayton as the important centers in this country of the interurban railway industry.

The interurban railways, he said, have long since passed the stage when they could be considered simply as suburban extensions of city lines. They are doing a through business, which is constantly growing, and the later and more ambitious examples of roads of this class are built with a track construction inferior in no respect to the best practice of the steam railroad companies. They operate usually for the greatest part of their distance over private rights of way, and attain speeds which enable them to compete successfully with their steam-railroad rivals for nearly every class of traffic except long-distance passenger and freight business. This extension of the electric railway has introduced new problems of discussion, such as fares, transportation of freight, etc., into the operating department, as well as the exercise of the most advanced electrical engineering methods, not only in the transmission of the power at high voltage necessary to operate the cars, but in the car equipment as well. Up to the present, direct current has been used on the trolley wire or third-rail, but if the experiments with single-phase motors, which it is announced are soon to be tried, prove successful, the possibility of the direct application of alternating current to railway work will remove some of the inconveniences which now exist in the present system.

I will not take the time of the convention to give the statistics showing the advances made in street railroading during the last year. Some of them will be brought out in the papers to be read, and statistics on the subject are published in the technical press from time to time. It is interesting in passing to note, however, that eleven years ago there were about 1,800 miles of electric railways in the country, while to-day there are between 24,000 miles and 25,000 miles, and that against an investment eleven years ago in street railways of about $75,000,000, the total capital invested to-day is in the neighborhood of two billion dollars. These figures show that the time has come when we should no longer apologize for our existence, but should take a stand individually and as an association for the protection of our rights as a corporation.

The address entered at length into the relations of electric railways with the public. The contract between the public and the street railroads is a contract of partnership, and the interest of the partners is identical. What the public wants is the best possible service, and only by giving the best possible service can we obtain the largest possible returns for our money. Despite this close association of interest, it is the experience that there is scarcely any limit to the impositions which the public will permit, and rather cheerfully permit, to be laid upon street railway corporations. Legislatures and boards of aldermen seem to regard street railroads as fair game to be hit at as often and as viciously as anybody chooses, and the public newspapers, so far from taking into account the service rendered and furnishing protection against the schemes of demagogues, are rather inclined to regard injuries so inflicted with amused indifference, if not with positive favor. It was pointed out that in every other form in which property manifests itself, except in shares of corporate stock, it has well defined rights and valuable privileges. Money lent to the government at a comfortable rate of interest is no more directly employed upon the public business than that which is represented by the stock of a street railroad, and it is no answer to the claim that it ought to have fair treatment, that it ought not to be the object of special prejudice and attack to say that it is particularly valuable, for its value is strictly measured by the public service it renders. And yet the contracts between the public and the street railroad companies are being continually infringed upon by the imposition of new taxes and new requirements, and it has come to be considered almost an impertinence for a corporation so injured to offer ever so mild a protest.

It is not remarkable, he said, that in this situation the law should discriminate against corporations. The failure to assert rights when they are threatened is always taken as a confession that they do not exist, and encroachment follows encroachment with ruthless certainty. Timid counsels have so far prevailed among the street railroad companies in the adjustment of their affairs with the public that in many States there is a gross discrimination in the taxing laws against such corporations. He looks forward to the day when the shareholders in street railway corporations will stand up for their rights as shareholders in the same sturdy spirit which they would at once bring to the defense of their rights as individuals. The great street railway properties of this country, and even the little ones, are no longer in the hands of a few rich men. They are distributed in hundreds of thousands of shares, ranging in par value from five dollars to a hundred dollars, among a countless body of the people. The heads of these properties are no longer in any material degree their owners. They are, and are coming more and more to be, simply the salaried employees of a great number of shareholders. They conduct the business of these properties as a trust, and they have nothing to do with the stock market. Their one concern is to earn a dividend for their shareholders and pay it where it belongs. Every shareholder is as much interested to protect the property against unjust discrimination in the laws and to protect its reputation as a business organization as are any of those who are placed for the time being in charge of the property. It is no less their duty than it is that of the latter to insist that public officials shall treat these corporations equitably and honestly.

An important part of the address was devoted to the consideration of the future of the Association. It has served an honorable and useful purpose for twenty-one years, but the time, he said, may be at hand when the scope of its usefulness can be materially increased, and attention was directed to the broader field of electric railroading which this country will certainly see during the next decade. Referring to the immense mileage of interurban electric railways which has been built during the last few years, especially in the Middle West, broader problems are being forced upon the electric railway interests of the country, which naturally look to the Association as the exponent of their interests. This is only natural, because while these lines do not operate upon the streets, the electrical equipment problems connected therewith, as well as many of the other questions which arise in connection with their operation are the same as those which interest "street railway" managers proper. While it may appear inadvisable to change the name of the American Street Railway Association to accord with the broader field of electric railroading in which many of its members are engaged, it should be understood that the Association is not merely a street railway organization, but its scope covers the entire field of electric railway transportation. More than this, it may seen desirable to welcome the participation of all companies engaged in electric railway transportation, for the reason that there is no organization in the country which has accomplished so much, or at its annual conventions and exhibitions can afford anywhere near the same opportunity for instruction to those interested in electric transportation in its different phases. Heretofore no manager or engineer

of a trunk line company which is contemplating or has installed a system of electric traction could join this Association except as a representative of some street railway company; but in view of the interest which is being taken in electric railway equipment by some of the large trunk line interests and the undeniable future which electric power will have for such transportation, especially for terminal and surburban work, the question will arise in the near future, if it has not already done so, whether the benefits which this Association can confer are available for companies which are not now eligible to membership.

Various reports of committees were then presented, on behalf of secretary and treasurer and the executive committee. It appeared that there are 191 companies in membership, of which 88 companies are situated in Massachusetts, New York, Ohio, Illinois and Pennsylvania. The balance sheet showed cash in bank, October 1, 1901, $10,128; receipts during the year, $8,378; expenditures, $8,559, and cash in hand October 1, 1902, $9,948.

President Hutchins, of the Detroit United Railway, was introduced to the convention, but was not in good enough health to make any acknowledgement. Mr. Vreeland thanked him for all that had been done to make members and visitors at home and comfortable in Detroit.

Mr. C. D. Meneely, of the Brooklyn Heights Company, then presented a paper on "Transfers," which was read by Mr. H. A. Robinson. An abstract of this paper follows:

REGISTRATION OF TRANSFERS.

A considerable portion of the paper consisted of a discussion of the chief arguments that have been advanced for and against the registration of transfers, the conclusion arrived at being that the advantages more than compensated for the disadvantages. An account was given of the system used on the Brooklyn Rapid Transit Railway, the operation of which is as follows:

Transfers are taken out of the hands of conductors and transfer agents are placed at points where cars from the same depot intersect and transfer, thereby preventing conductors from trading directly with each other and compelling the use of an intermediary. This is supplemented by the vigilant watchfulness of inspectors and secret service operators. The system of stationing uniformed register inspectors between all principal terminal points and the first transfer intersection practically protects the revenue between the outer transfer and terminal points, and enables the company to concentrate its secret service in the central portion of the system to locate register shorts and detect transfer trading. Further, to limit the risk of trading to the day of issue, the company introduced and was the first to use a daily dated transfer ticket, which has since been adopted by many of the principal systems in the country. Doubtless, a further check upon transfer trading is provided by the turning in of transfers by trips and the subsequent checking of line exchanges by the accounting department.

Mr. Meneely said that were it not for the lottery law and a certain demoralizing effect that distribution of property by chance has upon the community by inculcating the gambling spirit, it would be possible to offer such inducements to street railway patrons as would absolutely check the cash fares received and the transfers issued. Such a governing inducement would be, to offer cash prizes of a large amount monthly, which would yet form in the aggregate only a small fraction of the amount which is now diverted from the company's revenue by conductors.

In addition to carrying a pad of transfers, the conductors would be provided with a pad of numbered cash-fare receipts, each one of which receipts would bear on its face an injunction to hold until the end of the month, when the bearer might be entitled to any one of a number of prizes, determined impartially by a drawing; the prizes consisting of a capital sum, together with lesser sums graded down to a large number of small premiums, which would distribute the cash prizes as far as possible.

The operation of the above plan would involve the issue of a transfer *only* for a cash fare. In practice it would work as follows: A passenger, boarding a car, would be asked by the conductor, upon payment of fare, if he wished a transfer. Upon receiving an affirmative reply, the conductor would issue a numbered transfer to the passenger from his pad, and upon turning in his pad would have to produce one cash fare for each transfer ticket detached from his pad.

All passengers who desire transfers are sure to get them, as they are needed for a ride on the transferring line, and conductors would, therefore, not be able to again issue detached transfers.

On the other hand, if a passenger, upon paying his fare, stated that he did not wish a transfer, it would become the conductor's duty to detach a cash fare receipt and hand it to the passenger. For every cash fare receipt so detached the conductor would also be held accountable for one cash fare.

The inducement for a passenger to take a cash fare receipt would be even stronger than in the case of a transfer ticket, as it might mean a large sum of money in case the number of the ticket drew a prize, and when a passenger, ignorant of its possible value, refused to accept his fare receipt, others would eagerly seek its possession.

Assuming that both transfer tickets and cash fare receipts were taken by passengers for all fares paid, the stubs returned by the conductors would accurately indicate the number of fares collected and would ensure the turning in to the treasury of all the revenue collected on the cars.

Several marked advantages would follow from the adoption of this plan, as for example, the reduction in the number of transfers used, since many persons, who would ordinarily take a transfer for a short ride after a long one, would prefer the chance offered by the cash fare receipt and decline the transfer, which carried with it no chance for a prize.

Moreover, the number of short riders would, probably, be increased to an extent that would realize a larger sum than the aggregate of the prizes offered, and, again, the trading of transfer tickets between conductors would be rendered absolutely impracticable, for each transfer detached from a conductor's pad would mean a corresponding cash fare to be turned into the company's treasury, and he would, therefore, be debarred from substituting transfers from other lines for cash fares.

While, according to the opinion of counsel, the operation of this plan would not violate the letter of the lottery law, inasmuch as no consideration is asked or received for the cash prizes distributed, yet the decisions under the federal lottery law, which absolutely prohibit the circulation of notices of drawings through the mails, in the opinion of counsel renders the operation of the plan inadvisable.

While, perhaps, the adoption of this plan might stimulate a speculative spirit in the community, it is unfortunate from the point of view of street railway companies that same similar scheme for the absolute protection of revenue could not be devised that would not contravene State or Federal laws.

In the discussion, Mr. Root, of New York, said he was opposed to registration in such large cities as New York. The paper was also discussed by Messrs. W. E. Harrington, H. W. Sloan, E. G. Connette, John I Beggs, the last of whom described the points of value in a registration system as applied to travel in Milwaukee. Mr. W. B. Tarkington said that at Council Bluffs they registered transfers, with register bells of different tones, and that the public took quite an interest in watching to see what was rung up. Col. Hoft also believed that every ticket tendered as evidence of fare should be registered. The morning session then adjourned

At the Tuesday afternoon session, Mr. Oren Root, of New York, presented a paper on "The Street Railway Mutual Benefit Association," an abstract of which follows:

STREET RAILWAY MUTUAL BENEFIT ASSOCIATIONS.

The paper discussed at length mutual benefit and assessment assurance associations as applicable to street railway employees, and gave an account in detail of the Metropolitan Street Railway Association, of New York, which was organized in the spring of 1897. All employees of the Metropolitan Street Railway between the ages of twenty-one and forty-five who have been in the service of the company for three months are eligible for membership upon the payment of $1 and dues of fifty cents per month.

In return for these payments the association guarantees to its members:

1st. In case of sickness the payment of $1 a day for a period not exceeding ninety days in any one year.

2d. In case of death the payment of $300 to any beneficiary named by the insured.

3d. The free service of a physician who devotes his entire time to the members of the association.

4th. The use of reading rooms, which are supplied with weekly and monthly papers and magazines, technical journals and a library consisting of over 2,000 volumes.

5th. Use of ten pool tables, for which 1 cent per cue is charged.

6th. Free monthly lectures and entertainments during the winter months at the association rooms.

7th. Eligibility for pension under the pension regulations of the Metropolitan Street Railway Company.

The association started with thirty members, and from that time it has steadily grown until to-day it has a membership of over 4,500. The association is operated with absolutely no expense beyond the stipulated salary of a physician, as all of the officers of the association are officers of the company and their services to the association are given gratuitously. The association rooms are given rent free by the company; the library and pool tables were donations from individual stockholders and directors. It has been found that the amount of the tax, 50 cents per month, is a trifle more than is necessary to pay sick benefits and supply a life insurance of $300, but it is so small, in each individual case, as to make an exact adjustment both inconvenient and impossible, and hence there has grown up in this association a practice of investing the surplus in securities of the property on which the members are employed. There is thus the unique feature of every member contributing monthly, in an infinitesimal way it is true, to a proprietary interest in the property he helps to operate.

Mr. Root considers that the success of the Metropolitan Street Railway Association is primarily due, not so much to its sound economic features as to the personal relationship established and maintained between the responsible head of the railway company and its employees. An intelligent, sympathetic relation has been fostered and encouraged between the manager and his men who early realized that they were under the discipline of a man who was in thorough accord with them as a class and whose life experiences had been along the very lines they themselves were traveling.

The fusing influence of this relationship, which is as active to-day as at any time since the formation of the association, has welded the membership into a body, the tremendous force of whose loyalty has been frequently tested in critical emergencies. The impetus thus given to this association is great enough to assure its permanence beyond the accidental loss of the influence of the individual who is responsible for its present energy.

In the application of social benefits, as in everything else of human devising, some vivid personal influence is necessary to success, and this success cannot be achieved by mere formal approbation or endorsement. Many good things are spoiled by being over-magnified and among American and Americanized working men there is a resentment of official patronage. The quickening influence of the idea that you and your men are engaged on the same job, but in different capacities, when once fixed, is surprising. It would be well, too, not to lose sight of the fact that the benefits arising from helping your men to take care of themselves are not all one-sided.

The benefits arising from associations may be divided into two classes: First, those derived by the employees, and second, those derived by the employer. There is nothing which appeals more strongly to the large majority of people, certainly to those who have worked for a living, than those things which yield a direct or indirect financial return. No one can fail to see the great benefit which the distribution of from $20,000 to $25,000 a year means to the men who are working for wages, and without reserves to draw upon in cases of sickness or other disaster. The services of a physician, the free use of a library, the opportunity to play pool or billiards in a well-lighted and well-ventilated room at a nominal cost, are indirect financial benefits as well as pleasures which are assuredly appreciated by any body of intelligent workmen, such as are employed by street railway companies. There is a benefit not so apparent, but equally real in the creation and strengthening of a common spirit—"esprit du corps;" a realization of common interest in a work of many details, but of common end. The gain is the greater as all employees are included, from the helper to the manager. The perfection of army organization is where the soldiers have entire confidence in the leader, and the leader absolute trust in the soldiers. When something of the strength of all goes into the work of each, tasks are more easily done; there is more careful attention to details, a common interest taking hold beyond the working hours gives heart to labor, when the time comes. A street railway touches the public at numberless points; the work of its employees is at each of these points; work with something of heart in it is easier and better than mere hand and head work.

When one remembers that in such a scheme there is no demoralizing taint of official charity and that the men are gradually realizing that in truth they are doing all the helpful work with their own money, he will realize that the moral uplift far exceeds any of the material advantages.

The benefits of the second class from these associations—those to the employer or stockholder—are not so tangible as those received by the employee, but, nevertheless, exist to a large extent and are apparent to those who are in close touch with the workings of such associations and their bearing upon the management of the company's affairs. It may be difficult to demonstrate to an outsider, or to put your finger upon particular cases where the use of the library or the association rooms or the pool tables accrues to the advantage of the company. It is unquestionably true, however, that all of these things create a certain sentiment in the mind of the employee favorable to his employers, and which in times of labor troubles, when the misguided and unscrupulous agitator attempts to cause dissatisfaction, crystallizes into a feeling of loyalty toward the company which could not have been gained in any other way.

At the monthly meetings of the Metropolitan Association, which are held in the Association rooms and at which men of prominence and officers of the company speak to the men, the employer, as represented by the officials of the company, is brought into a personal relation with his employees, not as employer and employee, but as man and man, and in this way there is established a personal relation between them and a feeling of friendliness which certainly, in a large company like the Metropolitan, is not possible in any other way. As illustrated in the late trouble in Ohio which a large manufacturing company had with its men, it is possible to overdo this kind of work. When you begin to wet-nurse and patronize working men you are offending them and making trouble. The idea is to teach them to help themselves.

As an illustration of what opportunity for amusement means to working men, Mr. Root stated that one of the pool rooms located at Fiftieth Street and Seventh Avenue, takes in on an average of $45 per week. Several games of pool, at a cent a cue, must be played in the course of a week to make the receipts $45.

An interesting discussion of Mr. Root's paper was provoked, touching on various features and precautions necessary. Mr. Root said they had already begun to retire pensioners under the plan.

Prof. W. E. Goldsborough, director of electrical exhibits at the St. Louis Exposition, then made an address on the subject, and referred to plans for showing street railway traffic systems on a track of about 1,300 feet in length.

Mr. George W. Parker, general express agent of the Detroit United Railway, then read a paper on "The Transportation of Light Express and Parcel Delivery."

ELECTRIC EXPRESS AND BAGGAGE DELIVERY.

The paper contains a general discussion of the various questions involved in an electric express and baggage delivery, and gives an account at length of the details of such a service as carried on by the United Railway Company. The paper includes reproductions of a number of the forms used.

The establishment of the electric service is a boon to interurban towns, to which lines are being rapidly extended in all directions within a radius of from 75 miles to 100 miles, and in a great many cases reaching towns and villages which have never heretofore enjoyed a railroad connection, or at the best, in a roundabout way, entailing great delay and almost prohibitive expense. Electric service has also made next-door neighbors of communities, between which, before its establishment, even wagon communication was not satisfactory or feasible, so that the electric service may justly be

regarded as the chief factor in suburban progress, though not yet a decade old.

To the lay mind, the express and parcel business of the electric line or system would appear to be an additional and profitable use of the franchise, involving no additional expense beyond suitable rolling stock and the necessary train crew, but my experience has been that the operating expense tends to become greater than that of the passenger service, for the latter calls for no local stations or agents, the company assuming no responsibility before the passenger has been sighted, and after he alights, while it does become an insurer of freight or express from the moment of the giving of a receipt until it has taken one, thus necessitating a salaried agent and suitable depot facilities, stationery, etc.

In addition to the foregoing handicap to a profitable operation of the express service, there is an ordinance in Detroit which prohibits the use of trailers, and, worse still, which levies a tax of $1 per car per round trip, regardless of whether the car is empty or loaded. This tax is a radical departure from the good old days, when the town or its public-spirited citizens gladly raised a bonus to encourage a railroad connection, and then considered themselves highly favored.

The management of a system should show a proper appreciation of the importance of the express department and its bearing on the continued and increasing prosperity of the system in the building up of an interurban patronage, for it seems a necessary conclusion that the out-of-town dwellers will avail themselves of the mail-order and telephone facilities of the large city stores because of the convenient and speedy electric express car delivery to their doors, and the habit once formed of sending their shipments or orders via the electric express car must eventually result in more frequent trips on passenger cars for personal and wider selections of their requirements.

But it must not be assumed that all branches of the system, or even all towns and villages on a branch, warrant the establishment of an electric express service. The population, situation, products and future of each individual place, and the competition of existing steam roads, if any; also the old-established express companies, must be carefully weighed, or that terrible ledger must be faced at the end of the year.

To secure and hold the favor of the public, it has been found necessary to insist upon and maintain high-class service, which means all the little details of careful handling, prompt transit and courteous treatment. This naturally calls for the co-operation of the entire management, especially in the operating department, and the personal attention of the general express agent and his assistant at all hours in all kinds of weather and the ability to avert disaster when least expected. But he must not at any time neglect his office, to which all matters pertaining to the handling of express should be referred, and from which all instructions as to rates, claims, complaints, etc., should issue. The best results can be only obtained by the employment of a traveling express agent, whose special duties should be the soliciting of business and the securing of routing orders from consignees on shippers, which routing orders are instructions to shippers to forward all shipments in connection with the electric express. The paper then takes up in succession the various details of the express system organized by the Detroit United Railway Company.

In addition to what was said in the paper, Mr. Parker stated that the city passed an ordinance prohibiting them from loading or unloading on the streets, compelling them to put up a depot of their own, and still further taxing them $1 per car per round trip, loaded or empty. He added that the package service had had a beneficial effect in increasing the passenger service. Mr. Vreeland made a brief reference to the separate express service carried on over his tracks in New York by the Metropolitan Express Company.

Announcement was made of an invitation to the proper officials to attend a meeting on Thursday afternoon, to organize an association of master mechanics, etc., of the various roads. The notice was signed by Mr. Thomas Farmer, superintendent of motive power of the Detroit United System. The plan was heartily endorsed by Mr. Beggs, and Mr. Vreeland gave the experiences of the New York Railroad Club in discussions of the technical questions involved in changes of rolling stock, way, etc. Young men could not do better than read good papers before such bodies as a sure means of advancement.

The convention then adjourned until Friday morning. Thursday being entirely devoted to the examination of the exhibits.

Abstracts of papers read at Friday's sessions are given below:

THE ADJUSTMENT OF DAMAGE CLAIMS.

Mr. Mason B. Starring, of the Chicago City Railway Company, contributed a lengthy paper in which the subject of the adjustment of street railway damage claims was thoroughly discussed. Mr. Starring holds that the successful adjustment of damage claims depends largely on the personal equation; the personal and mental characteristics of personal adjustment being the main factor in all settlements. To further the proper adjustment of claims a proper foundation must be laid at the very inception; preparation for a law suit must go hand in hand with the preparation for adjustment. The paper enters at length into the procedure necessary in carrying out these principles. Having found a head of the department charged with the adjustment of claims with the necessary qualifications, the next matter of importance is that of getting facts, as facts are what win. Reference is made to the difficulties met when pressure of a social, political or financial nature is exercised. The management in charge should resist such influences, for many a good adjustment has been spoiled where yielding to a "pull." It is strongly advised never to compromise verdicts when results are unfavorable. Compromise should not be considered until there has been affirmation by a court of last resort.

SIGNALS FOR URBAN AND INTERURBAN RAILWAYS.

Mr. G. W. Palmer, in a paper with the above title, after pointing out the great desirability of an efficient and reliable signal system for electric railways entered into a discussion of the main features of such systems. He considers that all single track suburban and interurban roads should adopt the best obtainable block system, together with a telephone system which will enable a despatcher to reach any car crew at regularly established stations.

A signal to be reliable and efficient should be quick and positive in action; it should be impossible to set the cautionary or permissive signal at the near end of the block before setting the danger indication at the far end; incandescent lamps should not form a part of the main signal circuit, nor should the lighting and extinguishing of lamps be the only visual indication of the signal. This should be supplemented by the movement of an arm or semaphore blade which will move each time the signal is operated whether the lamps burn or not. The device will then be operative if the lamps burn out, as sometimes will happen. Manual control affords unauthorized persons a chance to interfere with the signal, and should not be depended upon; the setting and clearing circuits should be closed automatically, and when the signal has been set at danger it should lock so that it cannot be cleared until all cars have passed out of the block. It should be possible to set the signal only one way by two cars entering a block from both ends at the same time.

Special attention should be given to freedom from damage by lightning. As the pressure is liable to fall considerably at the ends of long lines, and also on parts of the system when heavy local loads are carried, the signal should be able to operate through a wide range of voltage, and should not be liable to damage through crossing of the signal circuit with the lines.

There are several systems now in use on electric roads, one using simply a circuit of lamps operated by a two-way hand switch at either end of the block, part of the lamps being lit as a permissive signal at the near end, while the balance indicates danger to an approaching car at the far end; this system is peculiarly susceptible to trouble from lightning, and also fails when any lamp burns out. As commonly used the switch and lamps are in the same box, and generally the car is run into a position where the conductor can easily reach the switch. In most cases the motorman then cannot see the lamps and depends on the bell signal from the conductor.

The proper method would be for the car to be stopped at a point far enough to the rear of the box for the motorman and passengers to observe the character of the signal, the conductor going ahead and throwing the switch; where the blocks are many, this will cause an annoying delay, which could be avoided by having the switch separate from the signal box, at a point about a hundred feet to the rear of it, and at such a height that the switch cannot be reached from the ground. When permission to proceed has been obtained, the motorman should not

enter the block until the conductor has struck two bells, thus making the men jointly responsible.

An improved method of operating the signal is by means of a circuit closer hung overhead and at a point sufficiently in the rear of the box, the circuit being closed by the passage of the trolley wheel; there are devices of this kind now obtainable which are reliable and effective in action.

A better system is one which uses a setting and clearing circuit separate from the lamp or semaphore circuit; most of these, however, can be cleared by the passage of any one car out of the block, and in case of running several cars together, all trolleys but the one on the rear car must be pulled down when passing the switch or if the leading car clears the block the car proceeding in the other direction must be notified of the number of cars following; this is an element of danger, as it should be absolutely impossible to clear a block while any car remains.

Some device should be used which will record the number of cars entering the block from either end, and hold the setting circuit closed until all cars have passed off the block. It should also be possible to clear the danger signal from both ends of the block, as it is often necessary for a car to leave a block from the same end at which it entered.

There are certain single track blocks on the Old Colony system which are operated by means of what is locally known as the "red stick." This is a small club or billet of wood painted red, which controls the block to which it belongs, and no car is allowed to enter the block unless it carries the "red stick," it being replaced by a red lantern at night. This is a safe but not very flexible system, the absence of the stick showing one that there is a car on the block, but not the direction in which it is going. Nor does it show when the block is cleared from the other end. In case of delay or blockade of cars going in the opposite direction the stick could not be carried back and all cars going in the same direction as the one which first entered the block would be held up. It does prevent effectually the "bunching" of cars at one end of the line.

There has been some work done along the line of cutting off the trolley current from a car which has not the right of way, thereby making it impossible for the car to proceed. This scheme seems to us to be a very attractive one, and it is possible that it may be effectively developed.

DISCIPLINE OF EMPLOYEES BY THE MERIT SYSTEM.

In a paper with this title, Mr. W. A. Satterlee gave an extended account of the system in use by the Metropolitan Street Railway Company, of Kansas City, Mo. This is an application of the merit system, in which a debit and credit account is kept, violations of rules being charged against the employee by a certain number of demerit marks, and merit marks are given for acts performed which are considered by the company as worthy and deserving of recognition. If at any time within one year the demerit marks exceed the merit marks by a certain number fixed by the company, then the party receiving them is liable to discharge. A list of violations of rules with the number of demerits for each is posted in frames at each reporting place, in order that the men may know in advance the penalties; and also a list of acts considered worthy of merit with the number of merit marks given for each. Whenever demerit or merit marks are given, a notice is sent to the subject notifying him of the fact, and a duplicate is posted at the same time at the reporting place. Whenever a man's demerits exceed his merits by 100 he is liable to discharge. The paper gives a list of several hundred offences and meritorious acts, each item being accompanied by the number of demerit or merit marks accorded.

Mr. Satterlee says he knows of no single change made in the old methods of operation, unless it be the adoption of the standard system of street railway accounting, that should receive a more hearty support from all. Certainly no system has been adopted that is fairer to the trainmen, or is more likely to produce in them a desire to keep their record clean.

There are many trivial acts, small in themselves, committed by trainmen in handling passengers, that as a whole tend to produce a feeling on the part of the traveling public, either favorable or unforable to the company, which once formed is hard to offset. Small acts of courtesy toward passengers by trainmen are felt by the management in ways unknown to the men who perform these acts, and are as far-reaching for the good of the company as small acts of discourtesy are damaging. To teach employees to be guarded in their talk, their acts, and their deportment on duty toward those with whom they come in contact, is a problem nearer solved in the

An abstract of a paper presented by Mr. Edward H. Suffern, entitled "The Steam Turbine—Its Commercial Aspect," will appear in a following issue.

CONVENTION AND EXHIBIT NOTES.

MR. R. W. CONANT, of Cambridge, Mass., had an exhibit of his portable bond tester as well as an instrument for determining whether the field coils of a motor have become short-circuited. The bond tester is so arranged that one man can attend to the rail contacts and the instrument a the same time. It is a Wheatstone bridge scheme, a telephone receiver and vibrator taking the place of the galvanometer. The device for field testing is of the induction type. A pulsating current is sent simultaneously through a field coil known to be perfect and through the one to be tested. When the induction is unequal, so that the circuits are out of balance a telephone receiver gives due warning to that effect. Mr. R. W. Conant was himself in charge of the exhibit.

CRANE COMPANY, of Chicago, had an exhibit of its high-pressure steam valves and flanges in charge of Capt. George A. Hurd.

UNION STOP AND SIGNAL COMPANY, of Fall River, Mass., exhibited an appliance to enable a dispatcher on an interurban road to stop a car by signal at any siding out on the line. Two wires are needed in addition to the regular dispatching telephone circuit. A time-stamp system of triplicate train orders is used, and a record kept at each telephone booth of the orders given; and no order can be taken from the booth without being first released by the dispatcher. The automatic counting mechanism in the apparatus seems to work very well. Mr. O. W. Hart showed the device in operation.

GOULD STORAGE BATTERY COMPANY, of New York, occupied Booth 3, and had a very neat and attractive exhibit of samples of their plates from the small size, 3 in. x 3, up to the largest types for central station work. Glass tanks and lead-lined tanks were also on view, showing the special form of glass covers for preventing spraying of acid and fumes. A number of framed photographs were also shown, of railway batteries and boosters in various plants, and copies were distributed of Bulletin No. 2, dealing with the Gould booster system. The exhibit was under the management of Mr. W. W. Donaldson, sales manager; Mr. E. L. Draffen, manager of the Chicago office, and Mr. A. B. Herrick, electrical engineer.

MR. LUTHER STIERINGER, the electrical expert, attended the convention, to staudy the recent developments in electric traction.

STANLEY EXHIBIT.—The Stanley Electric Manufacturing Company had a large exhibit in the center of the Armory Hall. The most conspicuous item was a large rotary of the kind already illustrated in these pages. It is a solid piece of mechanism, with a shaft 7 inches at the armature and 5½ inches at the bearings. The commutator is 33 inches in diameter. The bearings are 22 inches in length. In addition to the rotary was a complete S. K. C. substation with a three-panel switchboard, instruments, circuit breakers, switches, etc. One panel receives the alternating current for the rotary; another is for the direct current from the rotary, and the third is a double-feeder panel. The negative leads from the rotary are mounted on a separate pedestal, arranged for connection to the road by means of a special single-throw, single-pole, quick-break switch. The pedestal carries the equalizing switch, which is a duplicate of the negative switch. The rotary shown was purchased by the Indianapolis and Eastern Traction Company. The Stanley interests were represented by Dr. F. A. C. Perrine, president, and Messrs. Van Deventer, Arnold Bergenthal, Dodd, Ruchmore, Hough and Lillibridge. Mr. Joseph E. Lockwood, president of the Michigan Electric Company, made the installation, as the representative of the company.

JOHN A. ROEBLING'S SONS COMPANY were represented by Mr. H. L. Shippy, manager of the New York office, etc., and Messrs. Cockey, Bailey and Swan.

CHRISTENSEN ENGINEERING COMPANY, of Milwaukee Wis., had a fine exhibit of their air-brake apparatus and their new alternating-current machinery. The company showed a 30-hp 500-volt "Ceco" motor; a 400-hp, 500-volt enclosed "Ceco" motor; a portable motor-driven compressor in operation, and a 250-kw, three-phase, 2,200-volt "Ceco" alternator. The latter machine being new to the public attracted considerable attention. The company were represented

by Messrs. F. C. Randall, J. T. Cunningham, J. J. Neff, J. F. Dixon and J. H. Denton, of New York; W. W. Power and W. Gobel, of Philadelphia; H. N. Ransom and J. J. Riley, of Cleveland; J. E. Eldred and C. P. Tolman, of Chicago; N. A. Christensen, C. D. Knight, W. L. Waters, J. C. James, W. J. Richards and F. L. Hutchinson, of Milwaukee.

STANDARD PAINT COMPANY, of New York, had an exhibit in the gallery of their P. & B. paints and electrical insulating compounds, insulating papers, roofing material, etc. They were represented by Messrs. J. C. Shainwald, B. C. Beckman and E. R. Willard.

ALBERT AND J. M. ANDERSON, of Boston, had a neat exhibit in the gallery of their new section insulator. The insulating section over which the trolley wheel runs is so made as to be detachable at once for renewal if necessary, and the ends to which the trolley wire is fastened are so hooked to the main frame that they can be taken off by relieving the tension on the wire. The concern also showed their regular insulators, and gave out literature as to their plug for automobiles now in standard use. They were represented by Messrs. Ernst Woltmann and H. F. Sanville.

BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, were represented by Mr. F. G. Bolles, the energetic manager of the publicity and foreign sales departments.

H. W. JOHNS-MANVILLE COMPANY, of Hartford, Conn., had a fine exhibit of their insulators, heaters, enclosed fuses and other well-known specialties in space 41 on the main floor. They were represented by Messrs. J. W. Perry, J. E. Meek, E. B. Hatch, W. A. White, S. H. Finney, W. A. Buddecke, T. F. Becker and D. T. Dickson.

KELLOGG SWITCHBOARD AND SUPPLY COMPANY, of Chicago, Ill., had a neat and compact exhibit in the gallery of their telephone apparatus and system. They were represented by Mr. R. H. Manson, of the engineering department, and Mr. F. J. Martin, advertising manager. The exhibit consisted of their standard appliances, with various styles of telephones connected up and in working operation. The types shown were of the kind used in street railway work, hotel and office, series and bridging, desk stands of standard style, hand microphone forms, multiple jacks, lamp jacks, combined drops and jacks, ringing and listening keys, receivers, transmitters, transmitter arms, ringers, induction coils, repeating coils, cords, etc. The exhibit also included the small incandescent lamps that the company is now making in large quantities.

CONSOLIDATED CAR HEATING COMPANY, of Albany, exhibited their electric heaters in various styles, under the care of Mr. Cornell S. Hawley. Special emphasis was laid on their heater for cross seats and chair cars. One in fine finish was shown, as furnished recently for a private car of the Connecticut Railway and Light Company.

STANDARD UNDERGROUND CABLE COMPANY had an exhibit of samples showing their various cables in use for street railway work. A great deal of interest was aroused by the announcement of their new copper-rod and wire mills, recently erected at Perth Amboy, N. J., with the object of putting the company in a position to secure its "raw material" for insulation promptly. The company was represented by J. R. Wiley, H. P. Kimball, A. A. Anderson, F. S. Vielé.

SPEER CARBON COMPANY, of St. Mary's, Pa., had an exhibit in the gallery of street railway carbons, under the supervision of Mr. J. S. Speer himself. He showed a full line of their self-lubricating brushes for motors, lighting dynamos and electric railway generators.

LE VALLEY VITAE CARBON COMPANY had an exhibit of their railway carbons under the charge of Mr. J. V. Clark, president, and distributed a souvenir brush.

MORRIS ELECTRIC COMPANY had a very complete exhibit of the numerous specialties for which the vivacious and indefatigable Elmer P. Morris is agent, or which are manufactured by the concern and its affiliations. Something novel was given out in the way of a souvenir—namely, an amusing brochure, entitled "Just the Telling of It," by Miss Carmelita Beckwith, with illustrations by F. M. Follett. It deals with the wiles and idiosyncracies of salesmen, and there is a suspicion that Mr. Morris is himself the hero of some of the best stories. The brochure is daintily published by the Alwil shop, the owner of which is a son of Mr. Frank B. Rae, the electric railway engineer.

NATIONAL CARBON COMPANY had an excellent exhibit in the gallery under the care of Mr. R. K. Mickey, while Mr. Jas. Partridge looked after the interests there of the Partridge carbons Special attention was called to the Columbia self-lubricating brushes for high-speed and heavy work, and a large number was also shown of carbons for a wide variety of uses. Enclosed arcs were shown in operation, burning the National or Columbia soft-cored carbons. A special exhibit was made of the "Columbia" dry cells and "Autocells," the latter being grouped in special styles and sets for automobile work. The box is a sealed metal case, each cell surrounded by an insulating material which serves to make the battery, as a whole, waterproof and moistureproof. The connections are made so as to prevent loose or imperfect contacts, and the cell has either flexible wires or binding post.

MR. C. O. MAILLOUX, the well-known electrical engineer and electric railway builder, was beset by many inquiries as to his Portchester road.

ELECTRICAL WORLD AND ENGINEER had space on the main floor, and were represented by Messrs. J. M. Wakeman, T. C. Martin, J. V. S. Church, J. R. Cravath, G. S. Davis and Mr. A. C. Shaw, the European manager, now on a trip to this country.

AMERICAN CIRCULAR LOOM COMPANY were represented by Messrs. Jas. L. Kirkland, of New York, and Thos. G. Grier, of Chicago, who distributed data as to their conduit, and very neat pocket memorandum books.

MR. W. R. MASON, the veteran electrical supply manager, attended in the interests of the mechanical boiler cleaner he represents. It has been installed on a large scale at the Milwaukee power hous. With him was Mr. Charles Alexander, of Providence, R. I., a well-known merchant of that city, who is interested in the device.

ROSSITER, MACGOVERN & COMPANY were represented by Mr. Frank MacGovern, just home from Europe, and Mr. J. Warren Archer.

CROCKER-WHEELER COMPANY, of Ampere, N. J., were represented by Mr. Putnam A. Bates, from the home office, with Mr. F. B. De Gress. No exhibit was made, but on Thursday afternoon special cars ran out to Rochester to see the Crocker-Wheeler apparatus installed there. Mr. J. W. Harting was on hand from Detroit.

MR. HAROLD P. BROWN, of New York, made an excellent exhibit of his forms of plastic rail bond, and of the new mirror intended to aid motormen in watching road traffic behind them, or occurrences on the car itself. He distributed a handsome souvenir in the shape of an eraser, by which street railway men could rub out their errors. Mr. S. H. Dailey was with him.

NATIONAL LEAD COMPANY had a neat exhibit on the main floor of their well-known specialties in metal, wire, etc., and distributed souvenir pocket knives. They were represented by Messrs. W. H. Baker, W. F. Marks and R. L. Weithas.

STANDARD VITRIFIED CONDUIT COMPANY, of New York, had a select little exhibit of their high-glaze conduit, under the able management of Mr. J. B. Barnard, who had many opportunities to explain the merits of their system of putting the sections together with exterior doweling, and other points of advantage or general interest.

GOLD CAR HEATING COMPANY, of New York, had as usual, a very neat and attractive exhibit of their various specialties in the electric heating line, including car heaters, switches, office heaters, etc. Pres. E. E. Gold and General Manager J. E. Ward were in active attendance.

H. B. CAMP COMPANY, of Akron, Ohio, were represented by Mr. C. C. Baird, who had many roads to cite as using their conduits.

THE OHIO BRASS COMPANY had, as usual, a fine and comprehensive exhibit of their well-known line material and insulating specialties, and were represented by Pres. C. K. King, M. A. Bing, T. F. Classe, J. F. Mason, B. Gellatly, U. M. Garland, and others.

MR. GEORGE CUTTER, of Chicago, was present in the interests of the George Cutter Company, of Chicago.

WESTERN ELECTRIC COMPANY, of Chicago, were represented by Mr. C. W. Cobb, of Cleveland.

HELIOS-UPTON ELECTRIC COMPANY were represented by Mr. Frank H. Clark, of Chicago, who has already found a large field of opportunity for their storage battery in electric railway work.

NATIONAL CONDUIT AND CABLE COMPANY, of New York, were represented by Mr. S. H. Eckert, Mr. J. B. Horran and Mr. H. F. Tate.

NERNST LAMP COMPANY were represented by Messrs. Geo. C. Ewing, A. E. Fleming and W. J. Floyd, and had a large central chandelier carrying a number of multiple-glower Nernst lamps,

which, when burning in the evening, attracted no small amount of attention.

Mr. H. L. Doherty, president of the Denver Gas and Electric Company, and the recent president of the kindred body, the National Electric Light Association, took a deep interest in the proceedings, as many of the questions arising have pertinence also in the field of illumination.

Buckeye Electric Company, of Cleveland, Ohio, were represented by Mr. Eyre and F. M. Odena

Mr. C. J. Harrington, of New York, was present in the interests of the railway specialties that he represents.

Pittsburgh Reduction Company had an exhibit of their aluminum wires and cables on the main floor, and were represented by Mr. C. M. Harris, Mr. J. A. Rutherford, Mr. A. K. Lawrie, and others.

Triumph Electric Company were represented by Mr. F. W. Haines, of Detroit.

Sargent & Lundy, of Chicago, were represented by Mr. B. J. Jones.

Mr. F. E. Kinsman was present in the interests of the new Kinsman Electric Railway Supply Company, of New York.

Central Electric Company, of Chicago, were represented by Mr. R. L. Kimble.

Allis-Chalmers Company, of Milwaukee, Wis., were represented by Mr. Jas. W. Lyons.

Canadian General Electric Company were represented by Mr. A. B. Lambe, of Toronto.

Fort Wayne Electric Works were represented by Mr. A. L. Learler.

General Manufacturing Company, of Chicago, were represented by Mr. Walter G. McKinloch.

Ball & Wood Engine Company were represented by Mr. J. H. Naishall, of Detroit, and L. A. Parshall.

Shelby Electric Company, of Shelby, Ohio, were represented by Mr. Arthur Reid.

Prof. W. E. Goldsborough, of the electricity department, and Mr. Thos. M. Moore, chief of the department of machinery, attended in behalf of the interests of the St. Louis Exposition.

Stromberg-Carlson Telephone Manufacturing Company were represented by Mr. A. J. Rousseau, of Chicago.

Mr. B. H. Scranton, the president of the American Electric Heater Company of Detroit, Mich., dropped into the convention, and was very much interested in the latest developments shown and discussed. The company are very busy in the field of industrial electric heating.

American Vitrified Conduit Company, of New York, were represented by Mr. V. H. Yarnell.

Eugene Munsell & Company, and The Mica Insulator Company, were represented at the convention by Charles E. Coleman, manager for both concerns at Chicago. Mr. Coleman had a very prominent location in the center of the hall, in the space used also by William Wharton, Jr., & Company, Philadelphia. Micanite and Empire insulating materials were exhibited in their various forms, and the company's circular matter was distributed, which included a very neat blotter, distributed at the writing rooms of the various hotels. The company reported a heavy demand for all their micanite specialties, and have just completed an addition to their already extensive works at Schenectady, which will give them an increased capacity of 6,000 square feet of floor space, enabling them to execute all orders speedily.

Chicago Insulated Wire Company, of Chicago, who have a large and growing clientage in the street railway field, were adequately represented by Mr. William M. Smith, secretary and treasurer.

Mr. H. F. Sanville, of Philadelphia, was present in behalf of the Waclark Wire Company, of New York, and the Simonds Manufacturing Company—gears and pinions—of Pittsburg.

The General Supply Company, of 40 John Street, New York, were represented by Mr. A. B. Dalby, the manager of the street railway department. Mr. Dalby has a wide acquaintance and deserved popularity in the field, and should build up a large and profitable connection.

General Electric Company occupied 2,000 square feet of space. The principal feature was an installation of the "Type M" control now in use on the Manhattan Elevated Railway in New York City. This exhibit was mounted on a frame permitting free examination of the parts during its operation, and showing the rise in voltage corresponding to the increase in speed of the motors. To indicate this, a number of incandescent lamps was used, grouped in the form of the company's monogram, which started a dull red and gradually came up to full candle-power. Other apparatus consisted of a line of railway motors of various sizes, including the 125-hp "G. E. 66" motor, which has been adopted by the Manhattan Railway Company. A Brill "27 E." truck was shown with two "G. E. 57" motors, mounted upon it, and equipped with a new type of shoe for use on the protected third-rail system; this latter was here exhibited for the first time. There were also exhibited, in operation, air compressors of standard types with automatic governors, connected to a standard reservoir. A "Type H" electrically-controlled, oil-break switch, with a capacity of 300 amperes, at 12,000 volts, made an interesting operating exhibit, the switch being installed as in actual service. Direct and alternating-current rotary converter panels of standard types were also shown. Among the small supplies may be mentioned a 6,000-ampere carbon-break circuit breaker for railway use beside smaller sizes of the same type. An attractive display stand for rail bonds, incandescent lamp sockets and other small devices was also shown. A feature of considerable interest was a 50-foot interurban car, lent by the Jackson and Suburban Traction Company, and used by the company in demonstrating the system for operating such cars. This car is equipped with the "Type M" control and four "G. E. 66" 125-hp motors. The General Electric Company was represented, among others, by the following: Gen. Eugene Griffin and Messrs. J. R. Lovejoy, J. G. Barry, W. B. Potter, C. C. Pierce, J. J. Mahoney, T. P. Bailey, J. B. Pevear, G. D. Rosenthal, J. H. Sirsey, F. H. Gale, L. R. Pomeroy and E. H. Mullin.

Convention of the International Association of Municipal Electricians.

THE Seventh Annual Convention of the International Association of Municipal Electricians was held at Richmond, Va., Oct. 7, 8 and 9, and was the most successful that this progressive body has yet held. The attendance was large, and the greatest of interest was manifested in the papers read and the discussions to which they gave rise.

The convention was opened Oct. 7th with addresses of welcome by Governor A. J. Montague, of Virginia, and Major R. M. Taylor, of Richmond, the speeches of both having a ring of true Southern hospitality.

Numerous forms of entertainment were provided for the delegates and the ladies. The American Bell Telephone Company and Western Union and Postal Telegraph Companies gave free use of their lines to members and the Power and Passenger Company, of Richmond, were equally courteous.

Mr. W. H. Thompson, of Richmond, and Frank P. Foster, of Corning, N. Y., secretary of the Association, were untiring in their efforts to make the convention a success.

Mr. Walter M. Petty, of Rutherford, N. J., read a paper entitled "Municipal Inspection and Control of Electrical Matters," in which he suggested that the Association undertake the codification of a set of rules embracing all classes of electrical work, such as overhead construction, underground or subway construction, interior wiring, etc., and covering the licensing of

electrical workmen. In connection with overhead construction the rules should cover the proper placing of wires on poles, location of high and low potential wires, proper tagging of the same, reporting additions, etc., removal of dead or unused wires, location of transformers, and suitable protective devices, and, in short, embracing all possible conditions under which the wires are to be used. Similar rules should be drawn up to cover subway work. It was also advised that rules similar to those of the National Underwriter's code should be adopted and thoroughly enforced. The Association should lend its aid to movements toward the licensing of electrical workers. Laws should provide for the appointment of a State Board, composed of electrical engineers and municipal electricians; it should divide the workers into classes; it should also provide a proper examination of such workers and the issuance of certificates for each class, and impose a penalty for violation of the rules.

With the title "Electrical Government," a paper read by Mr. Austin S. Hatch, of Detroit, Mich., discussed the functions of that branch of city government having to do with electrical applications, but the major portion of the paper consisted of a warm defense of municipal ownership. A historical review of the latter subject began with "the origin of civilization in the valleys of the Nile, Euphrates or Tigris or along the shores of Europe," discussed the development under the feudal system and the "Hansic League," and finally comes down to this day of corporations, the "soulless, heartless creatures of law," to escape from which municipal ownership was urged as a refuge. Contrasting private and municipal ownership, the main object of the former was stated to be dividends and safety of investment, while that of the latter is quality of service rendered Consequently "the result should be overwhelmingly in favor of public ownership, and would be if it were not for a lack of development of efficient civil-service rules." As to politics, it was contended that corporations dominate not only city councils, but legislatures and even congress, and therefore the advocates of private ownership should not cast a stone on this score.

Captain William Brophy, of Boston, had for the subject of a paper "Relation of Electrical Interests to other Branches of the Municipality," in which he discussed at length the desirability of municipal control, the functions of a municipal electrical department and its organization. A brief account was given of several city electrical departments, and an extended history of that of Boston, and particularly of the manner in which it has been handicapped by incompetency and through political influence. In conclusion Captain Brophy said that he hoped that electrical departments now in existence are on a higher plane than that of Boston, and that those who contemplate the organization of such a bureau will not choose it as a model.

Charles L. Hopewell, of Cambridgeport, Mass., read a paper entitled "The Joint Use of Conduits," dealing with the subject of the joint occupancy of a single conduit system by all classes of electric wires. He considers that this is entirely practicable, and gives the following illustrations bearing on the point:

Mr. C. I. Walker, Chief Engineer of the Empire Subway Company, has publicly stated in a hearing at the Massachusetts Legislature that there are over twenty miles of conduits in New York City where the high tension ducts are directly over the low tension ducts with only a 6-inch concrete separation between these ducts. There was also a mile where the two classes of ducts were laid side by side with a separation of 14 inches. These ducts were morever of iron.

In Cambridge, Mass., the West End Street Railway Company constructed in 1897 a mile of conduit for their own wires and wherein the city was given two ducts. The city ducts enter separate manholes built by that company especially for the use of the city. These city manholes are now connected with manholes of the telephone conduit on the same street for the purpose of carrying the city wires from one conduit system to another. Mr. Walter R. Eaton, the Chief Electrical Engineer of the Cambridge Electric Light Company, has publicly stated that a combined conduit system using separate manholes was practical.

Mr. David R. Walker, for twenty-five years head of the Electrical Bureau of Philadelphia, has stated that the electric light and telephone wires have been in successful operation in adjacent ducts in Philadelphia for over ten years. The ducts used were of wood or tile and the cables entered the same manholes. In Rochester, N. Y., the Rochester Telephone Company have had over 250,000 feet of telephone cable in electric light ducts since May, 1900, and are installing 80,000 feet more. They have experienced no difficulty in operation although their cables enter the same manholes with the electric light wires. In Chicago over 100,000 feet of high and low potential cables have been in successful operation for the past ten years, some of the cables carrying current at 8,000 volts. These cables occupy the same manholes with the low tension wires, but are grouped on separate side of the manholes. On Atcher Aevnue, in Chicago, the Railway Company and the city have built a combined conduit system at a very large saving in cost over a separate system.

In Baltimore, Md., there are in use to-day over 5,000 feet of conduit used in joint operation by the high and low potential wires and occupying the same manholes. The conduit is owned by the city. The subject of the practicability of the operation of high and low potential wires in the same conduit has been investigated by two expert and competent commissions. One appointed by President Harrison, in 1891, for Washington, D. C., recommended a general conduit system with separate manholes for the high and low potential wires and the ownership to be by the city.

As to installation, such conduits should be built of non-conducting and permanent material, preferably of tile, have a double set of manholes and a subsidiary distributing system to contain only low-tension wires. Single ducts should be used for high-tension wires, as they will give a double wall between ducts; low tension ducts may be of multiple type laid on top of the high tension ducts and separated therefrom by six inches of concrete, the distributing ducts to be laid on top. The entire duct system should be embedded in three inches of concrete cement with a one-inch plank on top. Manholes should be installed at street corners as far as possible, one set to be for all high tension wires, and the other set for low tension wires. The high tension manholes should be a sufficient size to contain transformers and other devices, as only low tension wires should enter the distributing system. The paper concludes with an argument that the ownership of conduits should be by the public.

Mr. Jerry Murphy, of Cleveland, Ohio, presented a paper entitled "The Telephone Service in Connection with Fire and Police Signal Systems." The paper deals largely with fire and police signal systems. It was held that a telephone service is an excellent auxiliary of these; its use should, however, be discouraged as a means of fire notification.

CONVENTION NOTES.

KERITE WIRE was ably represented by Geo. F. Porter and R. D. Brixey, "a chip of the old block."

THE OKONITE COMPANY was talked about through the energy of Mr. Geo. T. Manson.

MR. THOS. H. BIBBER came on from Boston to talk about the merits of American Circular Loom.

MR. FRED. PEARCE, of New York, known by everybody, was kept busy.

THE MONTAUK FIRE DETECTING WIRE COMPANY, New York, was represented by Mr. F. S. Palmer.

THE MAGNETO ELECTRIC COMPANY, of New York, exhibited their System of Fire Alarm Telegraph without battery. Mr. P. H. Alexander, general manager, in charge.

MESSRS. J. JONES & SON, New York, were represented by Mr. J. Jones, showing a line of their Time Switches and other specialties.

THE AMERICAN ELECTRICAL WORKS had Mr. W. J. Watson, New York manager, in attendance.

THE JOHN A. ROEBLING SONS' COMPANY was represented by Mr. F. W. Harrington, of the New York office.

THE GORDON BATTERY COMPANY'S interests were looked after by Mr. W. C. Banks.

SAFETY INSULATED WIRE AND CABLE COMPANY was spoken for by Mr. A. P. Eckert.